Mining Journal

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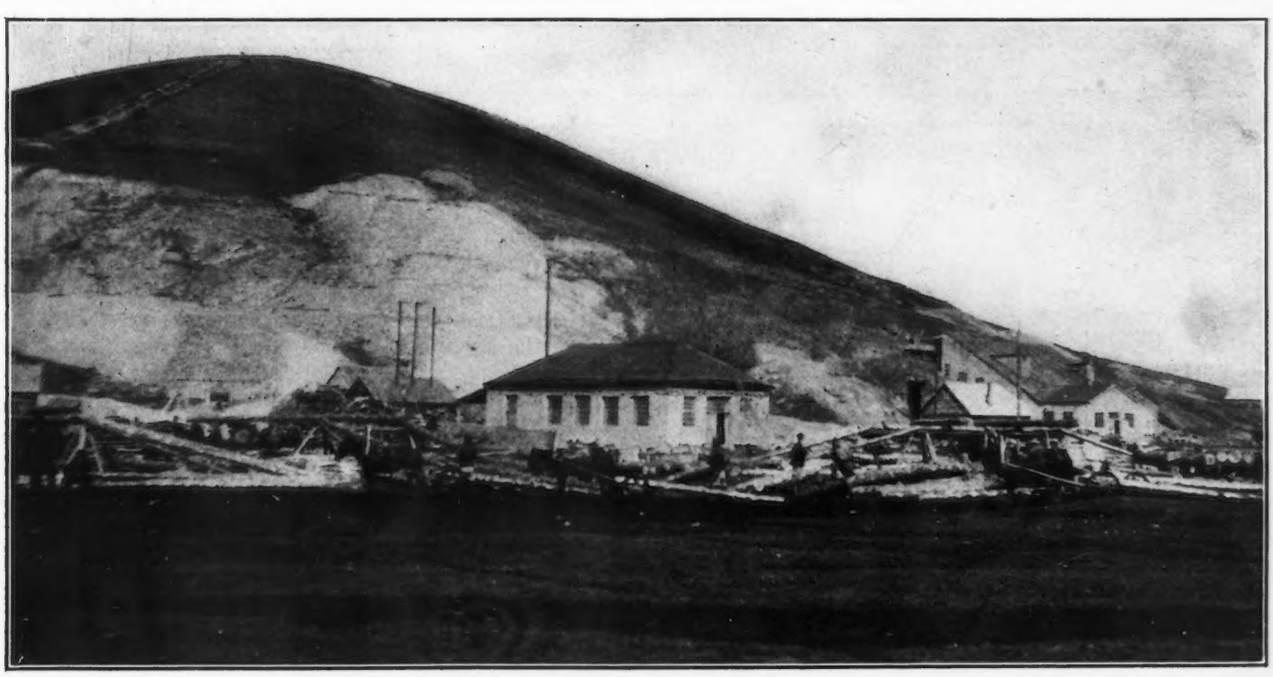
Ridder Mine of the Irtysh Corporation

SYNOPSIS—This mine, in the Altai Mountains in southern Siberia, is one of the world's important mineral developments of recent years. The mine was formerly worked for its oxidized ores; the present development is of the underlying complex sulphides that were of no interest during the previous period. There is a compact-sulphide orebody, estimated at nearly 900,000 tons of solid ore, beneath which is a zone of mineralized hornstone containing over 1,500,000 tons of "disseminated ore"; the most valuable metals are gold, zinc and lead, with silver of less importance and copper in small amounts. The ores will be concentrated at the mine and transported for smelting to the Ekibastus coal field, also owned by the Irtysh Corporation, Ltd. The Ridder concession embraces about 1600 square miles, and there are other old mines that present as favorable superficial prospects as Ridder, notably the Sokolny, which is now to be drilled to learn what underlies the oxidized zone worked in former years.

The Ridder mine in the Altai mining district of southern Siberia has been classed as one of the important mineral developments of the last decade. Mention has been made from time to time of this property, which has been under development by the Russo-Asiatic Corporation, Ltd., for several years. Through the courtesy of R. Gilman Brown we are now able to present some photographs taken in this region. The accompanying technical data are from the report of H. H. Knox, consulting engineer for the Irtysh Corporation, Ltd., which was formed to acquire from the Russo-Asiatic Corporation the issued share capital of the Ridder Mining Co. and of the Kirgiz Mining Co., which controls the Ekibastus coal field.

Acting on the recommendations of H. H. Knox and their technical advisers, the Russian companies have embarked on the following program: At the Ridder mine, diamond drilling will be continued, as well as the development and equipment of the mine for a minimum output of 600 tons of ore daily. The 50-ton test concentration mill will be enlarged to a capacity of 100 tons of solid-sulphide ore daily and plans for the first unit of a larger concentration mill having a capacity of 300 tons of solid-sulphide ore are being prepared. A water-power development is planned and surveys have been completed for a railway from the mine to Ust Kamenogorsk on the Irtysh River; arrangements are also



PART OF THE OLD OPENCUT AT THE RIDDER MINE IN THE ALTAI MOUNTAINS, SOUTHERN SIBERIA

Machine shop in center; shaft in center background; at the right is the test mill

being made for the purchase of steamers and barges for river transport.

At Ekibastus foundations have been started for a lead- and zinc-smelting plant, and exploration is proceeding at the colliery with drills and shafts in order to determine the most suitable location for new main shafts and plants.

The Ridder concession comprises an area of about 1600 square miles and forms a part of the Altai Imperial Domains. It is held by the Ridder Mining Co. under a 72-year lease from the Russian Cabinet. The Ridder group of mines is situated close to the village of the same name in the Government of Tomsk, about 50 miles east of Ust Kamenogorsk, on the Irtysh River. The river for six or seven months of each year, during open navigation, affords communication between Ust Kamenogorsk and Omsk on the Trans-Siberian Ry. The distance as measured by the windings of the river is about 750 miles.

Mines Formerly Worked for Oxidized Ores

The Ridder, the Sokolny and the Krukovsky mine have been worked extensively in the past on behalf of the Russian Cabinet for the precious metals. The limited technology and transport of the period admitted of the treatment only of oxidized ores. Hence the sulphide ores lying below the relatively shallow oxidized zone remained intact and virtually unexplored until operations were resumed by the Russo-Asiatic Corporation. Henceforth the wealth of the district will be derived not only from the gold and silver but also from the base metals contained in the ore.

The orebodies outcrop along the hillsides that rise from the flat valley at an elevation of 2400 ft. and culminate in peaks of the Altai, 7000 ft. above sea level. The slopes of the mountain afford ample timber for mining purposes and construction, and the mountain streams offer power at all seasons beyond any probable requirements.

Geology

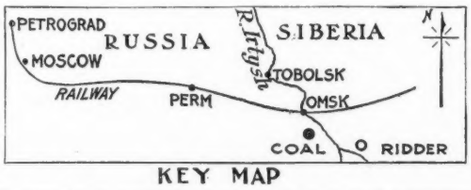
The country inclosing the mineral deposits is composed of a series of ancient sediments interbedded with igneous rocks. Among the former, slates and tuffs may be recognized, and the latter are represented by both effusives and sills. Since the deposition of the strata, the series has been tilted and metamorphosed.

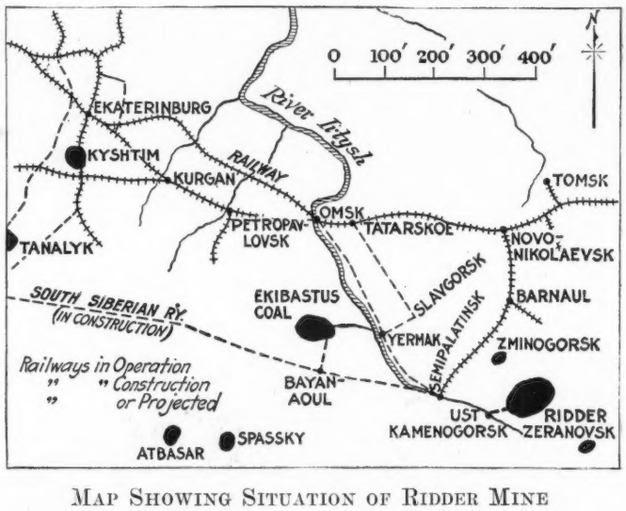
The hanging wall of the Ridder deposit is formed by a bed of shale which has been less altered than the other members of the series. The shale is usually succeeded by a band of crushed rock from a few inches to several feet in width, sufficiently mineralized to include it among the ores. Directly under this lies a compact sulphide orebody (the so called solid-sulphide ore), being a fine-grained aggregate of blende, galena, pyrite and chalcopyrite, containing gold and silver and minor proportions of quartz and calcite. This is succeeded by a zone of hornstone, originally probably a shale, highly silicified and brecciated, containing the same metallic minerals as the compact orebody, but distributed throughout the siliceous gangue and known as "disseminated ore." Further toward the foot wall the metal content diminishes, but sometimes appears again in other bands of higher tenor.

The orebodies, though varying in width between wide limits, are approximately conformable to the inclosing strata. The compact sulphides have evidently replaced a shale, whereas the disseminated ore is a partial replacement of hornstone. The various stages of folding, metamorphism, igneous intrusion and brecciation, culminating in the deposition of minerals from solutions, are phases of the general processes involved in the uplift of the Altai mountain chain. It is not unreasonable, says Mr. Knox, to surmise that the intrusive magma of the sill should have altered the adjoining shales to hornstone, that later crustal movements should have shattered the less altered shales immediately adjacent, thus affording channels for the circulation of solutions, and that these should have deposited their metallic burden by total replacement of the shattered shale as compact ore and by partial replacement of the less hospitable hornstone as disseminated ore.

The Ridder Lode

The Ridder lode has a general northwest-southeast strike. Within the workings it dips nearly vertically, but at greater depth, as shown by the bore holes. The



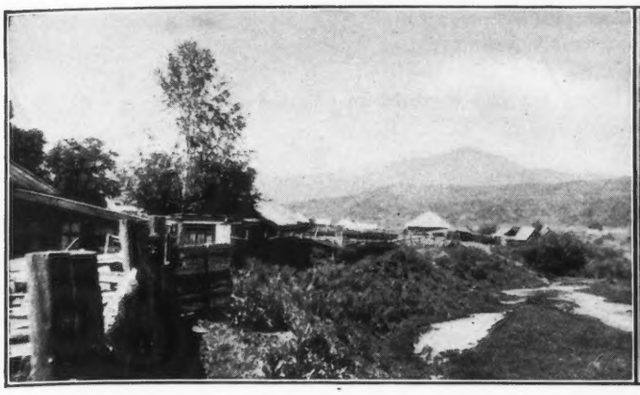


Map Showing Situation of Ridder Mine

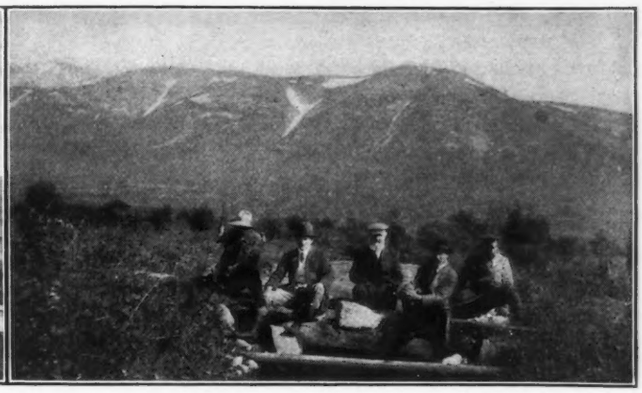
lode flattens out toward the west. The mine workings attain a depth of 175 ft. below the outcrop and extend 580 ft. along the strike on the fifth level. This level, about 140 ft. below the outcrop, marks the approximate limit of the oxidized ore which alone was sought by the old miners. In further exploration for such ore a sixth and last level was opened but without system, and consequently the exact knowledge of the extent of the orebody at the lowest mine level must await the further development now being prosecuted.

The sixth level was driven only about 35 ft. below the oxidized zone. In order to determine the further extent and quality of the lode, the management undertook exploration with diamond drills.

Two lines of diamond-drill holes parallel to the general strike of the lode were laid out; the first were 400 ft. from the outcrop and the second 170 ft. farther west. Along these lines drill stations, 125 ft. apart, were es-

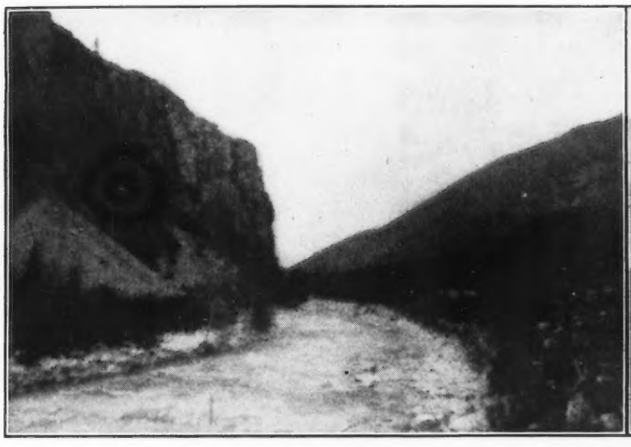


LOOKING DOWN THE FILIPOVKA RIVER IN FRONT OF THE RIDDER MINE

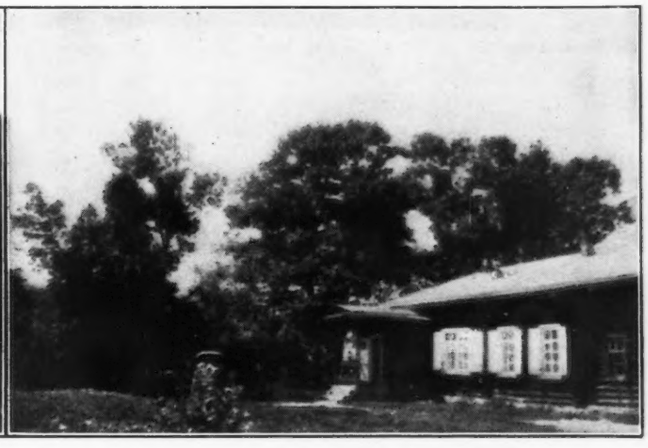


THE RIDDER VALLEY IN THE ALTAI MINING DISTRICT OF SOUTHERN SIBERIA

The Altai country is attractive and the climate is similar to that of New Hampshire. The Ridder mine is at an elevation of about 2400 ft., while the Altai peaks reach 7000 ft. above sea level

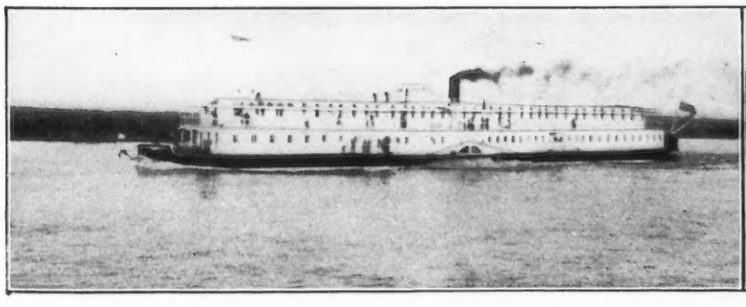


THE GRAMATOOK RIVER



MANAGER'S RESIDENCE, RIDDER MINE

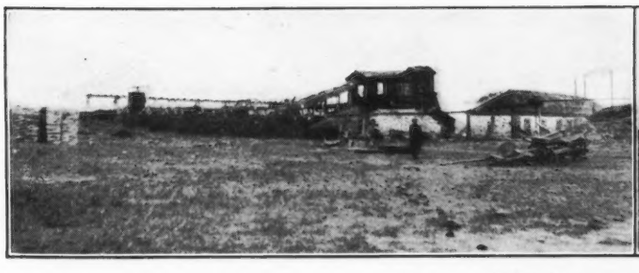
Power for the Ridder mine will be developed on the Gramatook River, which is seven miles from the mine



Steamer on the Irtysh River

Camels at the Ekibastus colliery

TWO MEANS OF TRANSPORT IN THE ALTAI



THE EKIBASTUS COLLIERY

The Ekibastus coal field will supply coal for smelting the zinc and lead concentrates and for general commercial purposes. The view at the left shows the main incline; at the right, the old vertical shaft and buildings now converted into a machine shop; coal heaps in background

tablished and from each a bore hole at a depression of 63° was projected to cut the orebody at vertical depths varying between 250 and 400 ft. At the date of the report nine of these bore holes were completed; none of the 12 holes had failed to reveal ore of profitable grade. A third line of holes is now being drilled.

Two Classes of Orebodies—36 and 110 Ft. Wide

The orebody is shown to extend at least 750 ft. along the strike and to attain a depth, measured on the dip, of at least 700 ft. from the surface, or 540 ft. measured vertically. The solid-sulphide ore is everywhere of profitable grade. Its average width is 36 ft. The disseminated ore, on the other hand, while generally continuous, here and there shows intervals of barren rock. As there are all gradations, from highly profitable ore to barren rock, the distinction between ore and waste must be marked by a value corresponding to the esti-

OREBODIES DISCLOSED BY RIDDER BOREHOLES

		Depth on Bore, Ft.	Width Ft.	Au Oz.	Ag Oz.	Cu %	Pb %	Zn %	Gross Value in Russia £	s.	d.
Solid-Sulphide Ore:											
A	1	267–290	23	0.86	7.8	2.1	19.1	29.2	17	0	0
	2	315–353	38	0.38	8.7	1.9	19.1	34.3	16	3	0
B	1	253–311.5	58.5	0.27	7.4	1.2	19.2	30.0	13	17	7
	2	308–340	32	0.39	14.9	1.3	18.0	30.6	15	3	2
C	1	286–398	112	0.45	12.5	1.3	17.9	33.4	15	16	0
	2	344–370	26	0.12	17.9	1.2	16.9	30.7	14	2	0
D	1	361–379	18	0.38	8.0	1.2	21.9	33.8	15	17	10
	2	Not yet started	....	....	....	....	....	....	..	..	..
E	1	318–339	21	0.23	10.2	1.7	19.3	38.4	16	10	10
	2	371–410	39	0.33	12.5	1.4	17.2	27.3	13	16	7
G	1	363–388.5	25.5	0.49	8.7	1.3	17.0	31.9	15	1	0
	2	447–489	35.5	0.21	10.2	1.4	13.7	24.6	11	3	0
Concentrating Ore (disseminated):											
A	1	290–512	222	0.56	1.0	0.4	3.0	5.3	4	14	0
	2	353–373	20	1.00	2.3	0.5	9.6	10.2	9	1	0
		373–466	93	0.32	0.9	0.2	1.1	2.7	2	7	10
		550–612	62	0.98	1.1	0.7	4.2	9.5	7	16	5
B	1	311.5–503	191.5	0.46	0.9	0.2	2.3	4.3	3	11	2
	2	300–308	8	0.46	5.3	0.9	7.1	12.4	7	11	5
		340–349	9.25	0.26	7.0	0.7	5.2	9.4	5	3	0
		456–620	164	0.65	1.8	0.5	2.7	4.3	4	16	2
C	1	258–286	28	0.10	4.0	0.3	3.7	10.8	4	8	2
		398–488	90	0.26	1.1	0.2	3.1	6.9	3	17	5
	2	338–344	6	0.07	4.7	0.2	5.2	8.5	4	1	2
		449–491	42	0.45	3.1	0.4	1.7	4.6	3	18	2
D	1	445–505	60	0.25	0.4	0.6	0.2	1.9	2	2	0
E	1	310–318	8	0.17	3.5	...	0.7	2.9	1	17	2
		339–440	101	0.16	0.6	0.3	1.4	5.1	2	9	5
	2	Returns not yet in	....	....	....	....	....	....	..	..	..
G	1	425.5–432	6.5	0.35	1.5	0.5	10.2	12.5	7	0	10
	2	489–540	51	0.32	0.5	...	1.0	1.6	1	17	7
Zinc Lode:											
A	1	740–755	15	...	...	1.2	...	14.9	3	11	5

mated cost of production. For present purposes, only material of a gross value exceeding £2 per ton was considered as ore; accordingly, the average width of the disseminated ore may be taken at 110 feet.

About 2,500,000 Tons of Ore Indicated

The explorations, to date of the report, are estimated to have disclosed about 883,000 tons of solid-sulphide ore and 1,565,000 tons of disseminated ore, making a total of 2,448,000 tons of both classes. The solid-sulphide ore is estimated to contain: Au, 0.43 oz. per long ton; Ag, 10.09 oz.; Pb, 17.62%; Zn, 30.90%; Cu, 1.37%. The disseminated ore is estimated to contain: Au, 0.60 oz. per long ton; Ag, 1.29 oz.; Pb, 2.89%; Zn, 5.60%; Cu, 0.33%. The total gross value of the solid-sulphide ore is estimated at £14.91 and of the disseminated ore, £4.73, being based on the following Russian prices, which in turn are based on London prices: Gold, £4 per oz.; silver £0.10 per oz.; lead £20 (London £16) per long ton; zinc £24 (London £20); copper £90 (London £60) per long ton.

The accompanying table summarizes the estimated values, costs and profits on these ores. It is estimated that the cost of production, based on a daily output of 600 tons (200 tons of sulphide ore and 400 tons of disseminated ore), including mining, treatment, transportation, royalty, and all other charges except depreciation and amortization, will amount to £2.38 per ton of ore, leaving a profit of £3.03 per ton, or a total indicated profit of £7,400,000 on the tonnage estimated

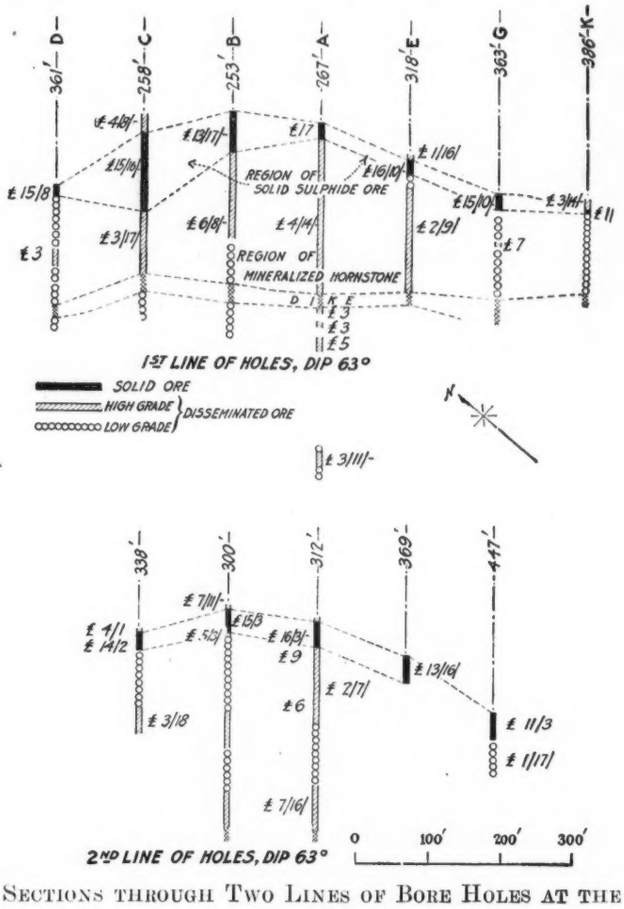
ESTIMATED VALUES AND PROFITS OF RIDDER ORES

	Assay Value	Recoverable Value	Operating Cost	Profit
Solid sulphide.....	£14.91	£9.82	£3.97	£5.85
Disseminated ore.....	4.73	3.20	1.58	1.62
Average.....	£8.40	£5.41	£2.38	£3.03

at this time. On a tonnage of 200,000 tons per year there would be an annual estimated profit of £606,000 for 12 years, without reference to further possible additions to the ore reserves.

Smelting Plant at Ekibastus

The complex nature of the Ridder ore will require concentrating and smelting works to effect a separation of the metallic contents. Assuming a daily capacity of 600



Sections through Two Lines of Bore Holes at the Ridder Mine

tons and the treatment of the solid and disseminated ore in such proportion as to preserve the average grade, a concentrating mill will produce daily 39 tons of lead concentrates and 146 tons of zinc concentrates. These products cannot be economically transported to Ust Kamenogorsk on the Irtysh River, 57 miles distant, over the rough wagon roads of the country, and therefore a narrow-gage railway is projected to this point. From Ust Kamenogorsk the concentrates will be transported by steam tugs and barges to Yermak, and thence by the company's railway to Ekibastus, where it is proposed to

erect the smelting works on account of the cheap fuel supply from the company's coal mines.

The suggestion of an assumed output of 200 tons of solid-sulphide ore and 400 tons of disseminated ore was merely as a basis for calculation, since the superior value of the solid sulphide renders it expedient that in the initial stages of the enterprise attention should be directed to the treatment of this ore, leaving the treatment of the disseminated ore to a later period, though it would be of advantage ultimately to extract the two classes of ore in the ratio of their occurrence.

Mr. Knox states that with respect to a mine but partly developed, such as the Ridder, the most uncertain item in estimating the cost of production is the cost of mining, and therefore an outside figure of 12s. was assumed for that operation. It is expected that in practice this figure will be materially improved, and each reduction of 1s. below the estimated cost of mining will add £10,000 to the annual profit. Metallurgical improvements may also be expected, and further accessions to ore reserves may increase substantially the assets of the corporation.

Outlying Mines

Of the old workings in the immediate vicinity of the Ridder, the most noteworthy are the Krukovsky and Sokolny mines. Of the former little can be said as the workings are inaccessible and only the rather extensive waste dumps give evidence of its former productiveness. Much of the Sokolny, however, is open to inspection, and the extent of the workings and size of the dumps confirm the records of its former importance. The suspension of activity is attributed to the exhaustion of the oxidized ores, as the sulphides had no interest at that time. The dumps compare favorably in value with those of the Ridder, although the precious-metal values are represented by silver rather than by gold as at the Ridder. Mr. Knox considers that the Sokolny "presents a field for exploration, possessing possibilities not inferior to those of the Ridder before systematic investigations were undertaken" and suggests that enough diamond drilling be done to secure a general idea of the Sokolny deposit.

The Ekibastus Coal Field

The Ekibastus coal field, owned by the Kirgiz Mining Co., was examined in detail by Forster-Brown & Rees, and is of importance as a source of fuel for smelting as well as for general commercial purposes. The mines are about 75 miles west of the Irtysh River and are connected with the river at Yermak (near Pavlodar) by a broad-gage railway, belonging to the company and now in operation. The basin contains seams of all grades, between bituminous shale and a good quality of steam coal, and there is estimated a profit of 10s. per ton for such coal as may be sold for commercial purposes outside the company's own requirements. A colliery equipment costing approximately £50,000 has been recommended for the mine at Voskresensky.

In the last decade there has been an influx of immigrants from Russia into this part of Siberia, and it is anticipated that there will be a plentiful supply of unskilled labor. Skilled labor, however, will have to be imported. Labor supply may be curtailed as a result of the war, but it may be remarked in passing that a Russian coal mine, after the vodka prohibition, discovered that with 50% of its force it was able to make a 130% production, as compared with the period when vodka flowed freely.

Mr. Knox recommended raising the sum of £500,000 in cash to be expended in putting the properties of the Irtysh Corporation, Ltd., in condition to return an annual profit of £600,000. The funds required for the equipment of the properties were provided at the time of the formation of the Irtysh Corporation, so that, despite the war, the company's developments are being carried forward without interruption except such as may arise from delay in the receipt of supplies and equipment.

Steam-Turbine Installation in Mexico*

For many years the Compañia Minera "Las Dos Estrellas" S. A., El Oro, Estado de Mexico, Mexico, has been purchasing its power from a public-service corporation. The slipping of one side of its greatest dam a few years ago seriously affected the power company for a time and caused heavy losses to innumerable customers. The Dos Estrellas company, being one of the several large consumers, in consequence installed a Westinghouse-Parsons multiple-expansion parallel-flow 1500-kw. steam turbine to generate three-phase current at 50 cycles and 3000 volts as a stand-by.

This turbine has a somewhat peculiar history. About two miles from the plant, in the center of a large masonry bridge, the trucks on one end of the car carrying the turbine broke down, precipitating the turbine to the river bed below, some 30 ft. Evidently, it did not wish to be installed at an 8000-ft. elevation. The machine was picked up uninjured except for a few paint scratches, and was installed and operated according to its specifications.

Shortly after, the turbine wrecked itself so completely that an entire new spindle had to be purchased. Failure to start the auxiliary oil pump, unintelligent operation and weak masonry foundations, allowing severe vibrations, were the causes, and conditions were made worse because of a 200-hp. compressor, operating on practically the same floor and foundation, the vibrations of which gave a harmonic with the turbine vibrations. Another fault was that the I-beams were set directly on the masonry wall instead of being placed on some sort of material to distribute the weight. The I-beams thus sank into the masonry, and the machine, instead of resting on the entire length of the foundation wall, was practically on the point where the I-beams had been.

To avoid further trouble it was decided to build a new foundation of 1 : 3 : 5 concrete directly under the turbine and do away with the masonry foundations, so designing the new work that the turbine would have absolutely no connection with the building or other apparatus except the condenser, etc. The change was made with some difficulty, inasmuch as the machine had to be kept ready for immediate use in case of emergency.

From Fig. 1 an idea can be had of the conditions. The dotted lines show the temporary timbering. The space directly beneath the turbine, between the old masonry walls, was dug up and the concrete footing *A* laid. Wall

*Excerpts from an article by John Klemm in "Power," Feb. 9, 1915.

B was built up to 5 in. below the 15-in. I-beam shown, and 12x12-in. and 8x8-in. timbering was placed between the new wall *B* and the old wall at *C*. This green timber was kept wet to prevent it from shrinking, so that the weight of the turbine could not come on the condenser. The old wall at *C* was then removed, a new concrete footing laid and the wall *C* built up and steamed to crystallize the cement, which was done in about 60 hr., thus avoiding the slow 28-day process.

For the steaming, ½-in. pipe, previously drilled with ⅛-in. holes about 6 in. apart, was laid all around the bottom of the wall; the entire wall was then well covered with a heavy canvas and the steam turned on. At the beginning the temperature was held below 35° C., then gradually increased to 70° C., at which it was maintained for 12 hr. Great care must be taken not to overheat the concrete and thus ruin the entire work, especially if it is reinforced, as the coefficients of expansion for iron and concrete are different. The steam pressure never exceeded 1.5 atmospheres, and with this it was found that the best work was done on the top of the wall. After the steaming, the electrical end was dried out before being placed in service, to avoid danger of a burnout.

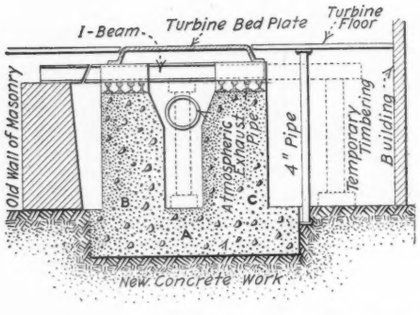


FIG. 1. REPLACING A TURBINE FOUNDATION

Full-length 40-lb. steel rails were then placed on the new walls *B* and *C*, Fig. 1, and 1-in. plates and steel wedges set tight against the 15-in. I-beams on which rested the turbine bedplate. These rails served to distribute the weight of the machine over the entire length of the walls. All spaces between and around the rails and I-beams were then filled in with concrete to the level of the bedplate, making of the whole almost a solid box-like construction with the opening in the center. It may be criticized as inconsistent with uptodate construction to allow so little space below the unit, but it could not well be avoided under the existing conditions. Moreover, the space was sufficient, as all high-speed machines, especially turbo-generators, have artificial ventilation, cold air being blown into the windings.

The timbering was finally removed and the I-beams, one end of each still in the old wall, were cut in a diagonal direction, as shown by Fig. 1, so that, in settling, the I-beams could not again make contact with the old work, the tendency being to settle away.

An additional installation of three 400-hp. Babcock & Wilcox water-tube boilers brought the total boiler capacity up to 2400 hp. This addition may seem unnecessary and a useless expenditure, but steam is always required for purposes other than power generation, and it is desirable to have ample margin for cleaning, etc. Further, it does away with the need for induced or forced draft and attendant loss of heat up the chimney, the extra cost of the apparatus and the disadvantages of its boilers.

There are no peaks to consider; the load is steady throughout the 24 hr. The lighting load at night is hardly perceptible. The boiler-feed water is taken almost directly from the condenser, a 4-in. pipe being tapped into the 12-in. discharge pipe of the circulating condenser pump (see Fig. 2). This 4-in. pipe discharges into an old fire-tube boiler used as a heater, and the water is then brought up to 90° C. from the heater. It flows by gravity to the feed pumps, of which there are two Worthington 10x6x10-in. The pumps are also connected to the Alberger cooling tower and a tank which is used to cool a 200-hp. Ingersoll-Rand compressor, so that when the turbine is not in operation the boilers still get warm water. Steam is required for other purposes for 24 hr. daily, and is held for emergency. The heater is also connected to the company's service mains through a small storage tank above the heater, as Fig. 2 shows.

There are two wrought-iron expansion joints in the 8-in. steam header line, one U between what are known

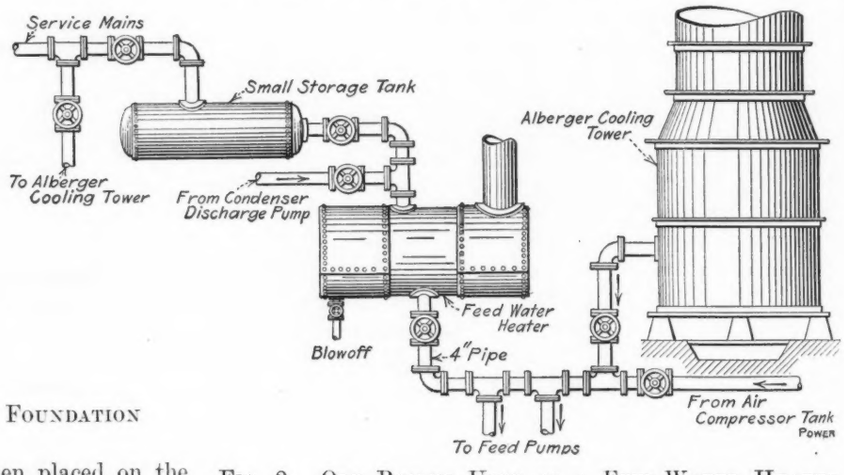


FIG. 2. OLD BOILER USED AS A FEED-WATER HEATER

as No. 4 and No. 5 boilers, and a 90° elbow between No. 1 boiler and the turbine. These suffice to take up any expansion in the header.

American fuel shipped to these regions comes high, costing on an average about 24.50 pesos per metric ton (2205 lb.) on the plant grounds.

Copper in Cyprus

United States Consul-General W. S. Hollis forwards an extract from a report by P. J. Louisides, which says that while Cyprus is in its infancy in metal production, its many deposits of copper are of economic interest. In historic times this island was well known for its copper mines, which are now unworked.

An American syndicate from Arizona has recently been organized and has sent here a mining engineer with a large amount of machinery to start work at Skouriotissia, about 60 miles from Larnaca, where promising copper fields have been located. At present the main purpose is to indicate the leading lines of the fields, and a systematic exploration is in progress. Several mining men are expected soon from Arizona to form the staff at the works.

Tin Mining in Bolivia

By Mark R. Lamb*

SYNOPSIS—Bolivia is one of the world's principal sources of tin, ranking second to the Straits Settlements, and producing about a quarter of the world's supply. At present the business is practically dead, due to the war difficulties. The production and minerals are described, and a plea is made for a tin-smelting industry in the United States.

Tin mining in Bolivia is nearly at a standstill. It is almost foolish to write about it, especially to Americans, when it is impossible to sell tin concentrates in the States (where three-quarters of the world's production is consumed). Instead of buying tin concentrates in Bolivia, smelting it in the States and getting all the business of the big Bolivian country, the States will continue to use the tin from the Straits simply because it comes in bars ready for use. Buying in the Straits will not help get a market for American products.

The Bolivian Tin Ores

It is true that Bolivian tin is not so easily refined as is the tin from streams, but it can be and is being refined in Germany for use in the States. It is all very well for the American manufacturer to sit back and say, "Let the producers of tin, nitrate and rubber find their own market and then buy what we want to sell them." But the producer is just as timid and unaggressive as the American user of tin, rubber and nitrate and is also sitting still, waiting for something to turn up.

The Bolivian tin ores contain lead, iron, antimony, bismuth, silver and other metals. The process of obtaining the tin consists of mining, crushing and concentrating. The concentration is divided into several systems. With ores of comparative purity it is simply jig, table and vanner concentration to obtain 60% concentrates. With somewhat impure ores and where there are pyrites in small quantities, concentrates are roasted and reconcentrated to eliminate the iron. With ores consisting largely of pyrites the ore itself is roasted before concentration. Where silver is present a chloridizing roast is given the ore and the silver leached out before the concentration for tin.

The tailings, as elsewhere, contain much tin, and lately tube mills have been put to work to grind the tailings still finer and permit a further concentration on vanners. One regrinding and reconcentration plant which cost $10,000 erected paid for itself in six months of operation.

Tin mining is not nearly so attractive as before the war. The shares of the tin companies have dropped and all the plants are working on the smallest scale possible. It is rumored on the street that Llallagua and Patiño are negotiating with an American company for the sale of their mines. If the American tin consumer wants an opportunity to get into the tin-producing business he has a fine opportunity at present, as the stocks of the best companies can be purchased at the lowest prices recorded. Even silver miners cannot continue working, though there is supposed to be a market for silver in London. Some have heretofore shipped cement silver; others have shipped silver sulphides; but neither is being shipped at present, and any definite offer or real money at a reasonable price would find several tons of silver per month.

Mining in Bolivia is not easy. It is not possible to import labor, on account of the altitude, so the work must be done with the native Indians. These are not bad laborers, considering how they are mistreated and neglected, but no one can work at 12,000 ft. and above as satisfactorily as at sea level, and the supply of Indians has been short. Of course, now, when the mines are running under low pressure, the supply of labor is greater than the demand, and many of them are ready to work for their board.

Transportation Difficulties

Transportation facilities are scarce and expensive. The Antofagasta railway is slowly getting to be a real railway, though many of its patrons call it an excuse for high rates, loss of goods and delayed deliveries. For a time it looked as though the control of this line would go to the Farquahar syndicate, and the users of the line were hoping for a change of management, but their hopes were blasted.

After leaving the railway, transportation to the mines is by means of llamas, which means that machinery must be sectional where there are no cart roads, and food should be packed in small boxes. There are a few cart roads, but it takes an expert to keep from getting lost when following them.

Short railroads are building or are completed to Potosí, Unica and Cochabamba and others will be built—later. Probably the demand for tin (say eight years after the war) will be sufficient to stimulate and finance the Bolivian government to the extent of providing the funds necessary for railway extensions. The new Chilean railway from Arica to La Paz has opened up new districts and has reduced the freight rate to the plateau. The traffic is not yet in good running order, but the line is used so far as the equipment and the rolling stock permit.

Fuel Scarcity

Until lately fuel has been an important and expensive item for the Bolivian miner. Everything possible has been used. This includes peat, moss and llama dung, besides imported anthracite for producer-gas engines. Now that the Antofagasta railway has reluctantly decided to put tank cars on its line to Bolivia, it is possible to use Diesel engines. The freight rate on the oil is determined as freights in the States used to be fixed—at all the traffic will bear. For some of the mines it is necessary to provide carts and small drums for packing the oil, and by the time it reaches the mine it is as valuable as 30-year-old stock.

Fuel is so expensive that the drying of concentrates is often done in the open air. This also applies to the native copper concentrates at Corocoro, where the copper is pure and brings a high price in normal times. On account

*Mining engineer, Huerfanos 1157, Santiago, Chile.

of this fuel item, the smelters on the highlands have made special provision for helping their employees. They provide a stream of hot slag where the women may cook. There is probably not a house in all Bolivia that is heated during the winter as we heat in the States, and when it is realized that Bolivian snow is cold, one of the disadvantages of life on the top of the world will be understood.

The Problem of Packing

Heretofore we have always taken pleasure in complaining of the handling given our machinery in the coast ports by the British and German ships. Now, if any American ships happen to come down here, we shall probably have to complain of them. It is really not the ship's fault that the ports are not ports or that the sea is rough at times. The goods must be got out of the ship and they do this as quickly as possible. Passengers and baggage are dragged up the side of the ship and up the ladder. The ship rolls without noting whether or not there is a passenger on the ladder. Sometimes the passenger gets only a wetting. At other times the ladder is folded up against the ship's side, and the passenger then gets a wetting plus a squeeze. It takes a biograph to show this boarding and leaving of the ship, and it takes a timid woman to describe it.

Machinery for Bolivia must be marked so, as it must pass through Chilean or Peruvian territory to get to Bolivia. Besides being properly marked with weight, gross and net, it should be carefully boxed. This boxing has been mentioned before and is so important that the local representatives of American exporters have a hard time in doing business when their products are not carefully boxed. Heavy machinery can stand more rough treatment than other things, but even it suffers at times. So if a plain slide-valve engine is damaged, what is likely to happen to furniture or pianos or glassware?

I have just returned from a trip to the States and had an opportunity to make practical demonstrations of how packing should be done, so far as concerns my own interests. It can be taken as generally true that nothing breakable should be packed in less than 1-in. lumber where the boxes are small and light and in 1½-in. where the contents are heavy. Personally I do not consider crates acceptable under any circumstances. Food, liquors and clothing should have nothing on the case to indicate what the contents are. Delicate shipments are frequently protected on all eight corners with heavy pads of jute to prevent jars. It is an excellent scheme to rebox light cases in a second heavy case. The customer likes to have trouble opening cases, and he does not object to heavy boxes. Lately I had the pleasure of seeing a shipment of mining machinery unloaded at a Chilean port without a breakage—with one exception. A Case oil-fired furnace was packed in a crate (!) with the muffle in place! There was nothing left of the fireclay and brickwork, and the buyer must have been delayed at least three months for the spares. In another shipment a Curtis pneumatic hoist was crated all set up, with the result that valves, bolts and in fact everything removable were gone.

Another shipment of a mechanical classifier was boxed in such light lumber that some of the boxes were being forwarded entirely empty! Whatever became of the contents is not known, but as they were brass they undoubtedly are serving a good purpose somewhere.

Structural steel has been shipped to Bolivia which was 10 ft. longer than the longest car. This means that a few feet of steel entailed the cost of an extra car, and I have tried to convey the idea that freights in Bolivia are not low.

I saw one small induction motor unpacked after it had been out in the rain and snow for two weeks. The owner was confident that it was ruined, or at least that a long drying would be required. The motor was packed in three boxes of tongued and grooved flooring with tarred paper between, and was as dry as when shipped. The extra boxing may have cost $3 more, but it saved the motor.

Condition of the Trade

At present, the business of selling to Bolivia is nothing and is not likely to increase for many months. The only business of importance so far as their purchasing is concerned is machinery, and with tin without a market, the companies are buying nothing. The one other product of Bolivia, outside of copper, is rubber, and this also is having trouble finding an outlet. It is usual for the machinery men to make a trip to Bolivia once in six or nine months, but no one is going this year. Even before the war the tin market was bad, so that the entire loss of market was only a slight additional loss.

Lately it has been possible to make shipments of tin concentrates to England to be sold at private sale, as there is no public market. The prices obtained have not been so very bad, though this way of selling is so uncertain that all the mines running are running on a reduced output. It would be a fine thing for me if someone in the States would buy tin concentrates and smelt them.

[We do not think that American metallurgical people are so backward about the tin-smelting business or so blind to its possibilities, as Mr. Lamb and many other writers suppose. Many years ago A. C. Burrage built a modern tin-smelting works at Bayonne, N. J., intending to supply it with black tin from Malaya, but the government of the Federated Malay States put a quietus on that business by imposing an export tax upon black tin. Mr. Burrage then scoured Bolivia for an ore supply, but was unable to get it on terms that suited him; his works were never fired up and finally were torn down. The erection of a tin smeltery involves a good deal of money, and an adventurer in that direction naturally wants to see a reasonable probability of getting his money back, besides a profit, which means that he must have an ore supply guaranteed by the possession of a mine, or else by long-time contracts giving a smelting margin that will cover both amortization and profit. The Bolivian miners who are free to contract their ore have been unwilling to enter into such engagements. They are willing to sell their ore at present at almost any price, but they want to be free to find the highest bidder after the war. That does not offer an alluring prospect for anybody putting his money into a new tin-smelting works. If the attitude of the Bolivian mine owners were different, capital would quickly be found to build tin-smelting works here.—Editor.]

Base Map of Missouri—A very accurate base map of Missouri has just been issued by the Missouri Geological Survey. It is 42x50 in. and on a scale of 1 to 500,000 or about 8 miles to the inch. Railroads and the principal streams are shown in detail. The county outlines and the elevations above sea level of railroad stations and precise bench marks are also shown. The map may be obtained by addressing H. A. Buehler, State Geologist, Rolla, Missouri. The charge is 15c. to cover cost of packing and transportation. The same map mounted on cloth and attached to wood rolls may be obtained for 60c.

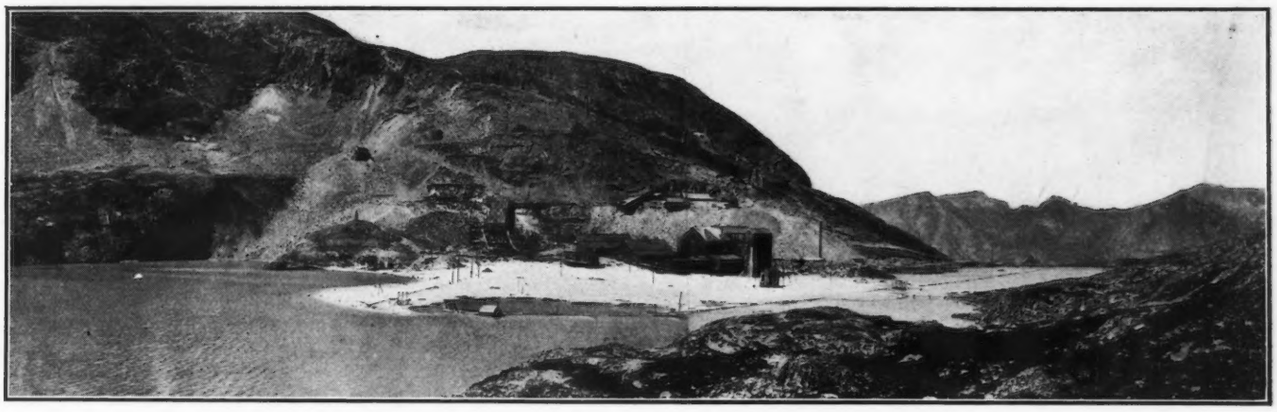
The Mears-Wilfley Tailings Mill

By Warren C. Prosser*

SYNOPSIS—A novel installation to treat an old tailings dump in a lake bed. The tailings are washed to the mill through a flume. The most notable feature in the mill are some Wilfley tables with a deck 47 ft. long.

A procedure which in itself is novel and which embodies a departure from lines laid down in general milling practice is that of treating fairly low-grade tailings with giant Wilfley tables, conducting these tailings to the mill over a long distance by fluming. This has been in progress near Silverton, Colo., for the last year, which time has been consumed in the construction of the plant and a trial operation.

The Silver Lake mine, situated in Silver Lake Basin[1] at an altitude of 12,150 ft. above sea level, was equipped in 1891, when owned by E. G. and G. H. Stoiber, with a 50-stamp mill containing crusher, rolls, Wilfley and Woodbury tables, Harz jigs and end-shake slime tables. For two years the mine did not produce very good ore, considered from an average-grade standpoint, but thereafter for seven or eight years the ore was fair and occasionally of excellent grade. The ore treated was of such a nature that the metallic minerals—sulphides of lead, copper, zinc and iron—were readily freed from the quartz gangue matter without fine grinding. It is estimated that the saving made was rarely higher than 60% of the combined values and in all probability much less the greater part of the time. This was, by the way, the first mill in the San Juan to operate successfully above timber line.



Silver Lake Basin

The outcrops of the Silver Lake vein, the remains of the old mill (burned), the mine buildings, the tailings in the lake, the pump boat and pipe line are all to be seen in this picture

The tailings from this mill were emptied into Silver Lake during the time of operation, covering nearly 10 years, and it was to treat these tailings that the Mears-Wilfley mill was built on the west bank of the Animas River, near the lower Silver Lake tramway terminal, two miles northeast of Silverton.

A small covered flatboat on the lake, moved from place to place by lengthening and shortening tie cables anchored on the bank, contains the motor sand-pump set. A pipe connection supported on floats is made to the foot-valve hose, which hangs from the end of the floats. The sand and water feed is drawn through the pumps, thence through a rubber hose to a 6-in. pipe line, also supported on floats across the lake to its north end. Here the contents of the pipe line are emptied into the natural steam bed and travel thence to the top of the cliffs which separate Arastra gulch from Silver Lake basin, a distance of 3500 ft. at an elevation of 12,000 ft. They plunge thence down through a gorge in the cliffs and are picked up at the bottom at an elevation of 10,700 ft. A 12x12-in. flume on a 9% grade conveys them to a dewatering tank about 200 ft. down the slope.

This dewatering tank is about 14x20 ft. and 8 ft. deep, built V-shape. It is divided into two compartments, the first being a screen compartment with valve-governed outlet to the creek. The second and larger compartment has several outlets to the covered flume line, the whole being protected from rock and snow slides by a framework of timbers and lagging.

From the dewatering tank the 12x12-in. covered flume line, on first a 9%, then on 6% and 4% grades, conveys the tailings to the top of the hill at the river, opposite the mill, a distance of about two miles and dropping to an elevation of 9600 ft. Here the material is introduced into a 6-in. pipe line by means of a long wedge-shaped box, the pipe line leading thence to the mill tanks over a trestle across the river. In the pipe line there are three openings, valve-governed, one of which is directly over the stream, to be used in case of emergency.

The mill tank is divided into compartments arranged with baffle partitions and bottom discharge gates protected from clogging by hydraulic cleaning jets. The mill building is 90 ft. long and 52 ft. in width. It contains two giant Wilfley tables, an 8-ft. Traylor tube mill, two Wilfley sand pumps and four of the new-style 24-deck Wilfley slimers, with necessary launders, pipes, shaftings and motors.

The giant Wilfley tables, which are the first of the kind built, are 47 ft. long, 12 ft. wide at the head end and 8 ft. wide at the concentrate end. They are supported on 16 rocker rods, double ball and socket operated, with

*Mining engineer, Silverton, Colo.

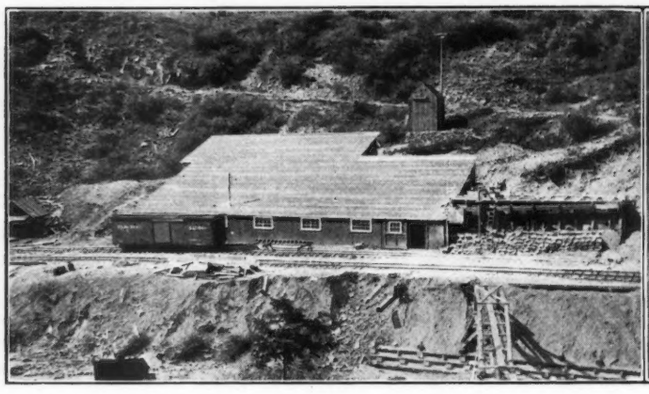
[1] "Eng. and Min. Journ.," June 20, 1914.

sidewise motion prevented by rocker maple spring boards, one end being fastened to the table, the other to the foundation. The decks are made of rigid wooden frames, with diagonal strips fastened thereto and beam supports underneath. Pine is used in the construction. The top is covered with linoleum and the riffles are added. The table is practically the same style as the 16-ft. standard table, but nearly three times as large.

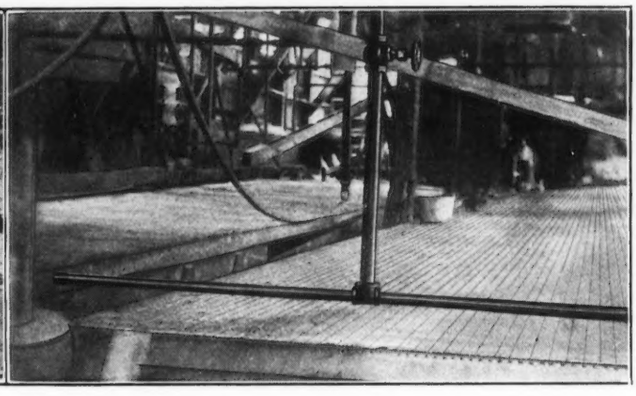
The slimers are of the 24-deck self-actuated automatic tilting variety.

The tube mill is of the short length, large diameter style, pebbles lodged in corrugated lining taking the wear. The pebbles cost $20 per ton laid down at the mill.

The sand pumps, used for raising the material from the lake and in the mill for raising material to the pebble mill and slimers, are of special design by A. R. Wilfley. In these the runner, of ordinary slotted type, is taper-fitted to the end of the drive shaft and nut locked. The inside face of the runner is flanged and packing is inserted inside the flange. By means of a spring a sleeve over the drive shaft presses a 1-in. sleeve ring against the packing in the runner flange, the sleeve being inserted into the casing through a stuffing box. The case of the pump is of cast iron of extra thickness and the end plates bind the whole together by means of bolts passing through slots cut in their peripheries. Grease is fed to the packing in the flanged runner to prevent wear at that point. Mr. Wilfley claims for this pump that the material passing through the pump is prevented from coming in contact with the drive shaft, thus eliminating excessive wear.



Wilfley Mill on the Animas River



The 47-Ft. Wilfleys from the Concentrate End

Operation

The entire plant and equipment are designed to transport and treat 500 tons of tailings in 24 hours. Some trouble was first met with in the pipe line at the Lake getting clogged by settled mineral particles, but a greater speed for the pulp regulated this. Some difficulty was first encountered in forcing the tailings through the natural stream bed below the Lake, and while lack of water in dry seasons might make it necessary to flume along this section, in times of sufficient water flow settling can be overcome by increasing the flow of water and decreasing the amount of tailings in transportation.

The flume line has been used unlined and has cut out quickly on the turns and grades. Lining with concrete is now under consideration.

The operation of the giant Wilfleys has been watched with some little interest. Some people feared that such a long table would be subjected to severe buckling tendency, but on the contrary, these tables are standing up to the work excellently. They have a throw of somewhat over one inch, and the material used in bracing has been sacrificed for reduced weight. In the short trial made no fault has been discovered.

The slimers are not operating solely on slimes, but, strange to say, have been showing results in the treatment of middling products. This same style of slimer has now been operating at the Iowa mill, and is reported to have paid for itself and to be making money for the leasing company which owns it. Details of its operation have not been obtained for publication. It is estimated that there are about 700,000 tons of tailings in the Lake, of which 500,000 are recoverable. The value is said to be $3.60 per ton. Otto Mears and A. R. Wilfley are credited with being the chief factors in the enterprise.

Geology of the Katanga Copper Deposits*

The Katanga copper deposits are situated on a plateau, the surface of which has been cut by erosion into numberless rounded hills and rather steep-sided valleys. The geological structure indicates that the country at some time past was mountainous; was later, as Cornet[1] holds, peneplained and still later eroded into its present rugged form; erosion has hence been rather deep. Elevations of the higher hills and the lower valleys are respectively 5200 and 3900 ft. above sea level.

Mineralized Hills Bare of Timber

The copper-bearing strata are harder, as a rule, than the associated rocks, and, in consequence, the ore deposits usually form cones or ridges. However, one or two of the deposits, notably Luushia, occur below low-lying land. The mineralized hills, in contradistinction to the surrounding timbered country, are bare, and between them and the forest grows the misuku or mahobohobo bush (a wild species of loquat), which is here a most excellent indicator of copper. The deforestation, due possibly to the presence of soluble copper salts in the soil and subsoil, has been a valuable aid in prospecting, as has the topographic relief of the deposits. C. Guillemain,[2] however,

*Excerpts from "Economic Geology of the Belgian Congo, Central Africa," by Sydney H. Ball and Millard K. Shaler, "Econ. Geol." Oct., 1914.

[1]Cornet, "Annales du Musee du Congo," series II, Tome I. Bruxelles, 1908, pp. 92-93.

[2]C. Guillemain, "Zeit. f. prakt. Geol." 1913 p. 324.

believes that the lack of trees is due rather to the soilless rocky outcrop of the hard beds of copper-bearing rocks, and states that all treeless areas are not cupriferous. He found, however, an azure blue flower to be confined to places at which copper occurs, growing only on outcrops, slag dumps, or piles of ore. Such bareness was noted by Messrs. Ball and Shaler in other copper regions, and probably is in part due to the presence of cupriferous solutions in the soil.

The rocks of this portion of the Katanga, in addition to various igneous rocks, consist of a series of sedimentary rocks, largely quartzose. They vary in age, according to Studt, from pre-Cambrian to Permo-Carboniferous, but following other correlations, from pre-Cambrian to Jura-Triassic. Sandstones and shales predominate, although dolomites and cherty dolomites also occur. The rocks differ widely in the amount of metamorphism suffered, the oldest rocks being thoroughly cemented and even

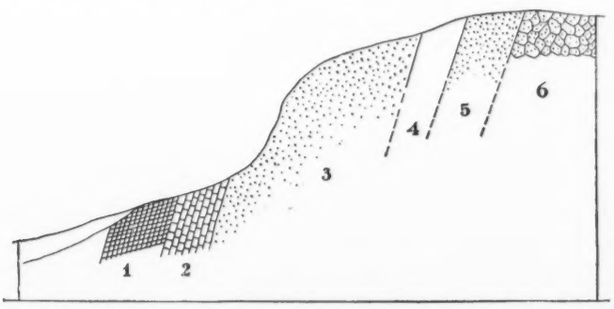


FIG. 1. SECTION OF LUKASI COPPER DEPOSIT, KATANGA

1, Hematite; 2, barren gray limestone; 3, 5, malachite-bearing sandstone; 4, pulverent oxides of iron, manganese and copper with malachite and chrysocolla; 6, quartzite with malachite in fractures and vugs. After Buttgenbach.

schistose and the youngest but slightly consolidated sandstones and shales.

SERICITE SCHISTS AND QUARTZOSE ROCKS THE CHIEF COPPER-BEARING STRATA

Most of the copper deposits occur in the Kambove and Lufira rocks; some, however, are in the Wemashi beds. The copper-bearing strata consist of sericite schists and quartzose rocks, varying from soft shaly sandstone to pure quartzite and in instances include also slate, dolomite and a cellular quartzose rock. These rocks are usually of light color near the ore deposits, because of bleaching. The interbedded reddish sedimentary rocks are barren.

Cornet[3] states that these rocks in Middle Carboniferous time were compressed into two systems of contemporaneous folds, junctioning near the Ruwe gold mine. The axes of one set in the Lualaba region extended from northeast to southwest, and those of the second in the central and southern portions of the Katanga, course from west northwest to east northeast. Studt, on the other hand, believes that the former were developed in pre-Silurian time and the latter in mid-Devonian time. The predominant dip of the west northwest folds is to the north. The majority of the copper mines are strung along like beads on chains in lines parallel to the later folds.

The ore deposits are characteristically associated with sharp folding, faulting, brecciation and an unusual degree of metamorphism (Figs. 1 and 2). The orebodies vary in size from comparatively small to large ones, the largest of which, Kambove No. 2, is reported to be 3000 ft. long and, so far as tested, from 240 to 400 ft. wide. The ore, as a rule, impregnates a sedimentary bed or several beds rather sharply defined from the barren country rock. In several cases orebodies occur in well defined anticlines (Fig. 3), and in one case presumably in a syncline (Fig. 4). The deposits are tabular lenses, and in the greater number of cases the orebody follows the dip of the country rock. The ore within each sandstone bed is discontinuous, but in the same bed several lenses may replace each other along the strike. Studt notes the fact that ore in instances may occur on but one side of an anticline or syncline. In instances, according to Stutzer,[4] the ore cuts across bedding planes and follows secondary structures such as schistosity. Studt[5] regards the quartzose cellular rock as a silicified dolomite altered by the mineralizing solutions which deposited the copper ores. The ore beds

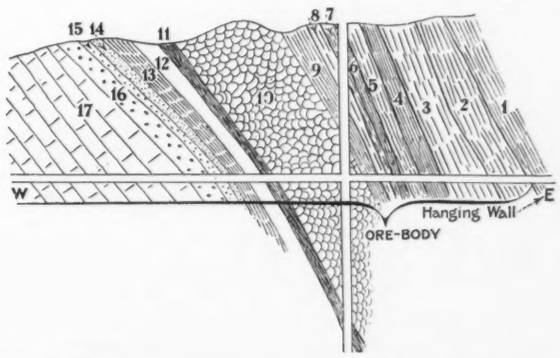


FIG. 2. CROSS-SECTION OF MAIN OREBODY, STAR OF THE CONGO MINE; SCALE 1 IN. = 50 FT.

1, Soft talcose-shaly schist, "talcose ore;" 2, green schist, "green ore;" 3, fissile schist; 4, siliceous schist; 5, laminated schist; 6, nodular schist; 7, laminated schist; 8, schist; 9, siliceous schist; 10, cellular quartzose rock; 11, hard schist; 12, black ore carrying considerable cobalt and good copper content; 13, ferruginous schist; 14, hard flagstone practically barren; 15, 16, flaggy sandstone; 17, dolomite ore—used for fluxing.

parallel this breccia, which is frequently in the center of the deposit, and cross the bedding planes at high angles. In the Kansanshi mine, a presumably similar deposit across the Rhodesian frontier, the copper ore occurs in vertical fissures at right angles to the stratification. The ore usually preserves its width in the upper siliceous beds, but splits into stringers in the underlying dolomite, which contains disseminated chalcopyrite grains. At the Star of the Congo mine, Studt states that the ore in depth is parallel to the cleavage rather than the bedding planes and that the superficial oxidized ore is replaced in depth by pyritiferous dolomite.

COPPER CONTENT VARIES WITH SCHISTOSITY AND POROSITY OF ROCKS

The quartzose cellular rock, which is much fissured, contains large masses of copper carbonates and oxides. Away from this quartzose band, the country rock is impregnated more or less completely with malachite, chrysocolla and azurite. In schists, thin sheets of these minerals occupy the closely spaced schistosity planes in such a way as to remind one, looking across the schistosity, of a book whose leaves are alternately green and white. In the sandstones, the plates of malachite are less closely spaced.

[3]Cornet, op. cit., pp. 75-94.

[4]"Metall und Erz," Vol. X (N. F. I.), heft 22, s 679-86.

[5]"Trans. of Geol. Soc. of S. Africa," Vol. XVI, 1913, Johannesburg, p. 52, also p. 68.

Finely divided chrysocolla, azurite and malachite also impregnate the various mineralized rocks, and the three minerals, frequently closely interbanded, occur in botryoidal and mammillary masses filling joint and breccia fractures. Atherton states that the amount of copper ore present varies directly with the porosity of the containing rock. Sandstones, once porous, are completely filled by copper ores, but massive flagstones are barren except for ore in fractures.

The most abundant copper minerals are malachite and chrysocolla; azurite, copper pitch ore and melaconite are less abundant. Cuprite, dioptase, native copper, lunnite,

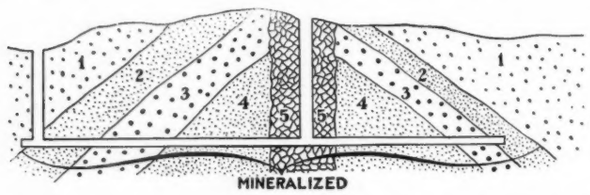


FIG. 3. MUSONOI COPPER DEPOSIT, KATANGA, SHOWING ANTICLINAL STRUCTURE

1, Barren sandstone; 2 and 4, sandstone; 3, quartzite; 5, "crush rock" (silicified dolomite). Adapted from Atherton.

libethenite, olivenite and cyanotrichite are rare, as is also a blue crystallized phosphate of copper and cobalt,[6] presumably a new mineral found at the Star of the Congo mines. Buttgenbach[7] reports the presence of two generations of malachite; an older, contemporaneous with the original gangues of the ore, and a younger, deposited in cavities from the solution of the other. Studt states that cuprite alters to melaconite and then to malachite.

SMALL AMOUNT OF SULPHIDE ORES

Sulphides are characteristically absent; however in native pits at Luushia, 6 to 12 ft. deep, chalcopyrite[1] occurs in shale with malachite, psilomelane and limonite. The chalcopyrite alters to malachite and limonite, and in consequence some of the malachite at least was derived from the alteration of sulphides. Chalcopyrite has also been found in veinlets at Kambove, and at the Musonia mine, impregnated sandstone. Both chalcopyrite and pyrite in small quantities were encountered in drill holes at the Star of the Congo mine at a depth of 60 m. Atherton reports pyrite at Kabolola, and believes copper glance to be present at Kambove. Studt mentions likewise the presence of chalcocite and also of bornite and covellite. The unimportance of sulphides is rather remarkable, in view of the fact that water level at the Star of the Congo mine is at a depth of about 50 ft., and at Kambove presumably at about the same depth.

[6]M. Cesaro, "Ann. de la Soc. Geol. de Belg.," Tome XXXIX, B, Liege, 1912, p. 241.

[7]Buttgenbach, "Annales du Musee du Congo," Series II, Tome I, Bruxelles, 1908, p. 40.

COBALT CONTENT NOTEWORTHY

Cobalt is present as an oxide, probably carrying manganese, according to Guillemain, also presumably as a phosphate of copper and cobalt. Calcite, quartz (both crystalline and chalcedonic), dolomite, limonite, hematite, and manganese oxides (both psilomelane and braunite) are common gangues. Barite occurs also at Kambove mine No. 1, and Buttgenbach reports that there a bituminous substance is associated with copper oxide and pulverulent manganese oxide. Hematite is not only intergrown with malachite but also forms bed-like bodies in the vicinity of the copper deposits. Magnetite crystals and graphite (Atherton and Buttgenbach) are presumably to be considered as original constituents of the country rock.

The ore is of good grade and Atherton estimates that in 12 of the larger deposits there is ore carrying from 6.3 to 14.4% copper, equivalent to 1,177,960 long tons of copper. The ore is either siliceous, aluminous, talcose, ferruginous or dolomitic; of these, the siliceous ores are most abundant, Atherton[8] stating "the general average being from 51 to 63% of silica; extreme cases go to 83 per cent." Typical analyses are given in the accompanying table.

Although the Star of the Congo ore carries no appreciable quantity of precious metal, in the other mines traces at least of gold and silver are usually present. The gold varies from 0 to 3 grams per ton, and silver reaches a maximum of 72 grams. Although small placers are derived from the copper deposits, Buttgenbach in panning the copper ore of the Kambove mine failed to get a color. The amount of cobalt is noteworthy. In 1911, the crude copper from the Star of the Congo mine contained 89-90% Cu, 5.5 Co, 0.3 Fe, 1.1 S; shipments in the summer of 1913 analyzed as follows: Cu 89.85%, Co 5.25, Fe 1.8, S 0.8 per cent.

ANALYSES OF KATANGA ORES

	No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SiO_2	55.62	58.40	67.19	74.21	34.9	33.80	46.60	8.00	28.95	57.40	43.70	47.00	55.40	74.40	61.65	66.40
Al_2O_3	2.65	5.90	5.67	3.85	16.6	10.50	12.70	.....	8.60	12.28	11.69	11.43	4.40	2.46	4.64	4.32
FeO	6.75	6.60	5.81	3.79	6.50	6.50	3.70	.....	25.10	4.88	2.40	3.50	2.50	2.25	2.73	4.27
MgO	3.05	6.50	2.31	2.35	13.70	14.00	14.40	20.00	2.37	.....	.....	.....	.....	.....	.....	.....
CaO	Traces	0.40	.....	0.05	.....	0.20	0.20	27.00	2.26	.....	.....	.....	.....	.....	.....	.....
CaO and MgO	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.95	8.95	10.82	6.06	3.18	5.90	5.74
Copper	8.00	8.60	7.10	6.63	11.30	13.50	8.10	1.20	15.20	12.45	15.20	14.13	16.26	8.79	13.53	13.03
Cobalt	0.24	.....	.....	.....	.....	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Phosphoric acid	0.13	.....	.....	.....	.....	.....	.....	(CO_2) 43.40	.....	.....	.....	.....	.....	.....	.....	.....
Loss	.....	.....	.....	.....	12.2	19.50	10.80	0.40	.....	.....	.....	.....	.....	.....	.....	.....

Nos. 1, 2, 3, 4—Siliceous ores, Star of the Congo mine. Nos. 5, 6—Aluminous or "green" ore: green schists in hanging wall, Star of the Congo mine. No. 7—Talcose ore in hanging wall, Star of the Congo mine. No. 8—Dolomitic ore in foot wall, Star of the Congo mine. (Another analysis shows 1% of Al_2O_3.) No. 9—Black ore, No. 12 of section, Star of the Congo mine (Fig. 2). Nos. 10 to 16—Analyses from north and south levels, Kambove mine.

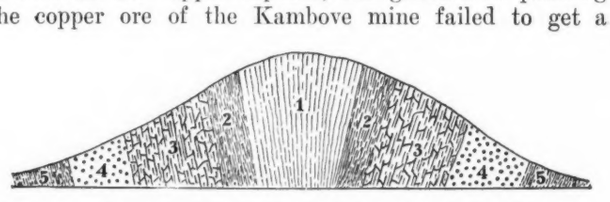


FIG. 4. CROSS-SECTION OF KIMBUI COPPER DEPOSIT, KATANGA, SHOWING PROBABLE SYNCLINAL STRUCTURE

1, Siliceous schist with many quartz veins; 2, filmy schist; 3, iron stained, brecciated schist; 4, cavernous quartzite; 5, soft fissile white schist. After Cornet.

The Katanga copper deposits are quite similar in mineral paragenesis and in form, and probably all have a common origin. Cornet believes these deposits to be the "iron hats" of copper-sulphide bodies, as does Buttgenbach

[8]Atherton, "Copper Deposits of the Katanga," July 31, 1907, Leeds, p. 10.

who expects further that the sulphide body will consist of chalcopyrite, bornite, hematite and magnetite, in a vein or veins parallel to the bedding of the sedimentary rocks. He states that the rocks containing the copper ores were folded in Middle Carboniferous time, and that the ore deposition was of similar age. Studt believes them to be deposited by magmatic waters connected with a granitic intrusion of mid-Devonian age. Stutzer is also strongly inclined to believe that the Star of the Congo mine is situated on the oxidized portion of a sulphide vein. Stutzer states that the Katanga orebodies are similar to that of Bwana M'Kubwa, situated in Rhodesia, on the Belgian Congo frontier, at no great distance from and on the strike of the Katanga belt.

The authors' personal observations are too limited to speak authoritatively upon the origin of these deposits. They were perhaps formed by ascending waters, as were the rather similar copper deposits at Atbasar in the Kirghese Steppes, Siberia, deposition having taken place partly through cavity filling in highly fractured areas, and partly by the replacement of peculiarly favorable rocks. Whether or not these waters were meteoric and under artesian pressure, or were remotely connected with some magma, is, of course, most speculative. Igneous rocks are not absent, as in addition to the granite of mid-Devonian age, which occurs near some of the orebodies in the southeastern end of the belt, there are in the Star of the Congo mine, according to Studt,[9] several dikes of minette or mica-syenite. To the north of this belt the apparently similar copper deposit at Kapula occurs along a granite contact. According to Gwyn-Williams,[10] the ores and the mineralized rocks are like those of the copper orebodies in the main belt.

Arizona Mining Legislation

SPECIAL CORRESPONDENCE

The mania for new legislation has probably passed its climax in Arizona. When the state was admitted in 1912, the Constitution then adopted provided for the referendum and the initiative. Recall of the judiciary was voted down at the time the Constitution was voted for, though some laid its later adoption to the fact that President Taft interfered with his veto—unwarrantably, as most Americans thought. Under the referendum a number of bills passed by the first state legislature were put to the vote, some of them extreme labor bills and some the other way. A bill of particular interest to mining men, which was known as the Miners' Lien law, was amended at the session just closed by providing that a prospector may bond his claims and by filing notice on the claims and in the Recorder's office of his county warn the world that he will not be responsible for any debts contracted by the lessees. Under a law, which was one of those referred in 1912, laborers and supply men could hold the claims, to which they had furnished labor or supplies, with a first lien even as against a mortgage made later than the date of the passage of the law. This was a most indefensible provision and destroyed the borrowing value of all the mining ground in the state, since it applied to patented lands, possessory rights, and every other kind of mine. This law was changed in the revision of 1913 to cover labor and material, though whether this change was of importance is not known. While the law as now amended does not go into effect for 90 days, it is thought that at the expiration of that time there will be a considerable increase in leases. As it was, no poor man or stranger could furnish the bond required by all careful owners, and even with responsible men it made dealing complicated. It was credited with sounding the death knell of development in the state, as the only persons whom it was safe to trust with one's claims were the very ones who did not want to lease. So apparent has been this dearth of development that it is confidently prophesied that no effort will be made to put the law to a vote.

At the last election in 1914 several radical laws were passed upon initiation by petition. Among these were the alien-labor law, which provided that not less than 80% of men employed in any occupation should be native born or naturalized voters. Since it is necessary to understand English in order to become naturalized, this law was confiscatory and was held unconstitutional by the Supreme Court, which decision will probably be confirmed in the higher court. Another law, the anti-blacklist, was practically held unconstitutional by the U. S. Supreme Court in passing on a similar law originating in Kansas. The old-age and widows'-pension laws have been improperly put upon the ballot and declared void by one of the Superior Courts of the state and it is predicted that the state Supreme Court will approve of this decision.

The Constitution adopted was considered progressive and provided for compensation laws, which were made to apply forcibly only to the dangerous occupations, being optional in a few others. This compensation to laborers, killed or wounded, is now in force and will require some changes to make it acceptable to anybody. It seems that the fundamental premise of all the compensation laws, namely, that each occupation or business should look after its own dead or injured, is radically wrong and that a law to cover the case and provide compensation must be made to apply equally to all persons of either sex and all ages, and be borne by the public at large. It is a fact that while a big mining company with a prosperous and profitable business can take care of its own losses, a small developing company would be seriously crippled by a death or two, and a poor fellow trying to open a mine would be eternally bankrupted by an accident resulting in deaths.

The last legislature passed a law taxing mines, upon a certain percentage of the gross plus a certain percentage of the net proceeds, this whole sum to be the value of the mine for taxation. But this law was only made effective for two years, so the Tax Commission will have to devise some method of mine taxation.

It is fair to say that while the people of Arizona stick to their guns as being progressive and in line with modern thought, they may be absolved from the charge of being radical, and the experimental symptons so much commented on last year are to be ascribed to only a small part of the population.

[9]"Trans. of Geol. Soc. of S. Africa," Vol. XVI, 1913, Johannesburg, p. 839.

[10]Gwyn-Williams, R. H., "Mining Jou·n.." Aug. 30, 1913, p. 839.

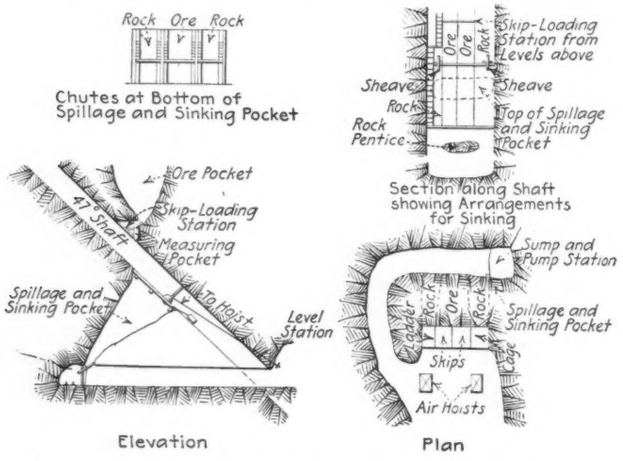
Wood Pipe for Conveying Water—"How long will it last?" is a question asked perhaps more than any other concerning the use of wood pipe, says "Engineering News." That the life of such wood pipe should be at least 20 years if the pipes are fully exposed and supported free from all contact with the soil, if the material is either fir or redwood, and if the pipe has been properly maintained, is the conclusion of a specialist of the U. S. Department of Agriculture in a professional paper on "Wood Pipe for Conveying Water for Irrigation" (Bulletin No. 155), which may be had free of charge by applying to the Department of Agriculture, Washington, D. C.

Details of Practical Mining

Spillage and Sinking Pocket

By Albert E. Hall*

Where skips are being loaded, either direct from cars or from a pocket, there is always some spillage. When work is going on below the loading point, it is necessary to keep this spilled material from falling on those below, and a pentice or bulkhead is often used for this purpose. If, however, the skips must make trips to the lower workings, the labor of removing and replacing a pentice causes loss of time. Even where the skips do not make trips lower than the loading point, the material spilled in loading has to be cleaned up at intervals, which is slow and costly work.



Plan Showing Arrangements for Sinking and Spillage Pockets

The pocket shown in the illustration serves the double purpose of catching the spillage from the loading pocket and also of acting as a pocket for the material hoisted from the shaft bottom during the sinking. The shaft in question is inclined at 47° and has four compartments, a ladderway, two skip compartments and a cage compartment. The cage runs to the sixth level, so that the cage compartment is clear below this point. The skips run to the seventh level, now the lowest level; below this point the shaft is being sunk. The loading station lies between the sixth and seventh levels. The illustration shows the general arrangement.

A drift was run in behind the shaft on the foot-wall side and a pocket raised to the shaft just below the loading pocket. This was divided into three parts and chutes built in the drift to correspond to these divisions. The center chute, as shown, catches the ore spilled while loading the skips above. This is drawn from the chute and trammed around to the pocket on the seventh level.

The other two chutes in the drift handle the rock from sinking. Two air hoists are used to hoist this rock to the pocket, one hoistman being able to attend both engines. Just above the spillage pocket, sheaves were set, one in the cage compartment and the other in the ladderway. The setting of the last was made possible by moving the ladder as near as possible to the wall. The rock drawn through the chutes is trammed around to the pocket on the seventh level.

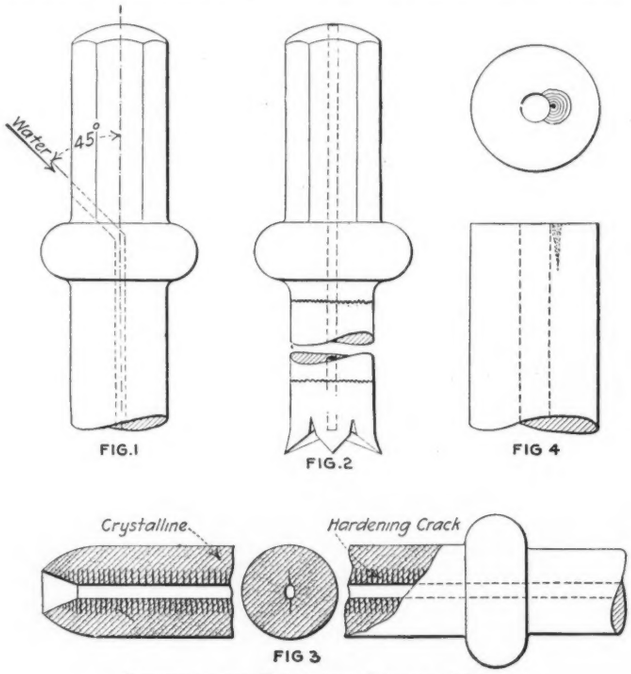
No extra labor is necessary with this arrangement. One hoistman handles both hoists and the buckets dump automatically. Two men handle all rock and ore coming through the chutes and tram it out.

*Mining engineer, Creighton Mine, Ontario.

Failure and Heat Treatment of Drill Steel

By Sven V. Bergh*

The development of the hammer-drill machine during the past decade has brought with it high requirements for the drill steel. As a consequence, the steel has from time to time been much improved. However, to use to the best advantage the steel at present on the market, it should be selected with regard to the work to be done, and the right treatment should be applied when the steel bars are made into drills.



Defects in Hammer Drill Steel

The steel generally used for rock drilling may be classified as carbon steel; hence the degree of hardness means the percentage of carbon contained. Experience has proved that the proper percentage of carbon is governed chiefly by the hardness of the rock to be drilled and by the power of the machine. E. Odelberg says in *Jernkontorets Annaler*, 1912, that he seldom found among mining men a right understanding of the fact that the

*Mining engineer, Chrome, N. J.

harder the rock, the softer must be the steel. This is due to the fact that the bit will not stand the impact if too hard a steel is used to penetrate hard ground, the degree of hardening necessary to improve the wearing qualities of the bit depending upon the conditions under which it has to be used. The above rule must also be applied when a heavier type of drill is being substituted for a lighter one and the steel does not seem to stand up well. The ultimate carbon hardness being already reached, a softer steel must be tried.

In some drilling practice, as, for instance, when hand-feed drills are used, bending stresses are likely to be put on the steel. Additional tensile and compressive stresses are thus induced during the period of the blow, producing an excessive strain in the steel. In such practice a heavy size of steel is to be recommended.

When the steel is shanked it is of importance to give the shank sufficient length and cross-sectional area. It happens not infrequently in mining fields, where a light type of drill has been substituted for a heavier one, that the old steel is continued in use. This is not advisable, for the additional reason that it necessitates a considerable change in the front head of the machine. The inconvenience of such a practice is shown by tests in the following table taken from my article in the JOURNAL, Sept. 26, 1914, p. 560.

EFFECTS OF NEW AND OLD CHUCK BUSHINGS ON DRILLING SPEEDS OF INGERSOLL M. C. 32 DRILL

Air Pressure Gage, Lb. per Sq.In.	Net Time of Run, Minutes	Depth Drilled, Inches	Front Head Bushing
78	3	14.6	New
78	3	12.2	Old

The number of ruptures may sometimes be greatly reduced by giving the shank a greater cross-sectional area. In 1911, tests were carried out at a mine in Sweden to find the effect of such a change. The rock at this particular mine is exceedingly hard to drill, as it consists of quartz-striped magnetite and hematite ore with leptite as a country rock. During a three-month period one and the same type of drill was used. The following results were obtained: Ordinary shanks ruptured, 185, corresponding to 6277 m. drilled; strengthened shanks ruptured, four (171 used in all), corresponding to 700 m. drilled. These figures show a considerable improvement following the use of the heavier shanks. Here it may also be mentioned that all abrupt changes in section and sharp corners should be strictly avoided.

So far as water-using drills are concerned, when the water is fed into the steel through a radial boring it has proved an advantage to drill the hole at an angle of 45° with the center hole of the steel, Fig. 1.

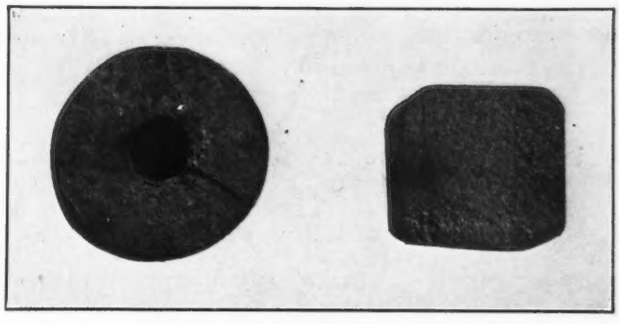
To shape the shank and the bit, the steel has to be upset at both ends. This operation changes the internal structure of the steel unfavorably, at the same time producing in some parts of it the bad effect of "cold work," due to the manner of applying the heat. Ruptures as shown in Fig. 2 are frequently seen. Thus to utilize the best properties of the steel it is necessary that the upsetting be performed in such a way that the steel receives the proper heat treatment. From this it may be understood why it is regarded good practice to forge and harden the bit in separate heats.

To obtain the finest grain, the bit has to be forged continuously from the highest temperature employed down to the finishing temperature, which probably is slightly above the point of recalescence. It is advantageous in hardening not to treat it to any higher temperature than necessary. The steel is liable, if heated too high, to change into a coarse crystallization and develop hardening cracks that may cause ruptures.

The shank must always be tempered properly after being hardened. Some good hints on this point are found in an article entitled "Hammerdrill Shanks," *Compressed Air Magazine,* October, 1914.

Finally, it may be mentioned that shanks sometimes rupture longitudinally, Fig. 3. Some cases that were investigated showed that the failure was due to careless straightening after the steel had been upset. The center hole of the shank was thus oval instead of round and this later caused it to rupture when the steel was used.

Two kinds of rupture may be distinguished, namely: (1) ruptures that appear as developed from a coarse-grained structure and (2) ruptures that evidently have developed from a partial break or inclosure in the steel. In regard to ruptures of the first class mentioned, the opinion frequently heard among users of drill steel is that the crystalline texture often found is due to vibrations. It is not my intention here to discuss whether such an opinion is wrong or not, but to call attention to the fact that the crystalline texture might have been caused during the manufacture of the steel bars by wrong or insufficient heat treatment. The crystallized steel is



SULPHIDE ACCRETIONS IN STEEL

sometimes hard to restore completely. By annealing, the crystals may only be more or less broken up, still maintaining their previous orientation. Thus cleavage planes are developed along which ruptures occur, giving the appearance of a crystalline fracture, although the steel in reality is fine-grained.

The typical fracture of the second class is as follows: A circular or oblong cavity or a crack is found at some part of a transverse section. This cavity or crack is surrounded by concentric rings covering a certain portion of the section, the rest being more or less covered by an ordinary crystalline fracture, Fig. 4. Mr. Catlin, of Franklin Furnace, called attention to ruptures of this kind at a meeting of the New York section of the Mining and Metallurgical Society of America, in January, 1914. He stated that according to his experience these inclosures seemed to run through the whole length of the steel and if it was broken anywhere, one could expect to find them. I am also able to state from my own investigations that this kind of rupture occurs rather often.

Similar ruptures are often found in connection with broken rails. Two interesting articles recently published upon this subject are to be found, one in *Iron Age,* Feb. 19, 1914, and one in the *Railway Age Gazette,* Feb. 6, 1914.

It is of practical importance to determine whether the inclosures mentioned consist of slag or of sulphide of manganese, the latter usually occurring in the form of round drops, which, if large in size, may be elongated by the rolling. Sulphide of manganese is best recognized by etching the surface of the fracture with a mixture of dilute hydrochloric acid and bichloride of mercury, when the sulphur appears as dark spots. A print may also be taken conveniently by exposing the fracture for four or five minutes to a piece of silk wet with the solution.

It may be of interest to many to hear that ruptures have also been found to start from groove marks on the steel, where numerals or other marks have been stamped by the drill runner.

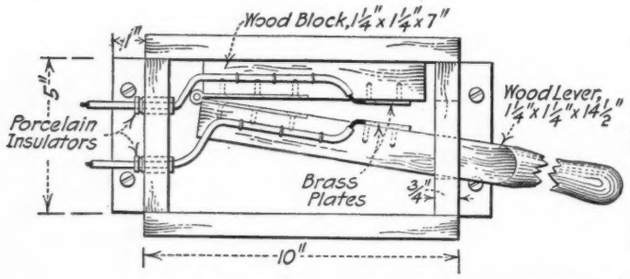
It is evident from what is now said that the annealing of the drill steel at intervals will mean only a partial improvement. Internal strains produced by cold working of the metal and coarse-grained crystals may be effaced, but there is no possibility of eliminating ruptures of the second class noted. This is in accord with what has been found at various Swedish mining fields where the practice is to anneal drills every second month.

So far as the steel problem is concerned, the structure of steel exposed to vibrations has proved to be of utmost importance. The sorbitic structure has been found to stand up best. It is obtained either by cooling the steel quickly through the so called critical range without actual quenching or by rapid cooling and then reheating to about 600° C. While I have found no publications on this subject, this treatment may be used.

Gravity-Release Electric Signal Box

By W. R. Hodge*

An electric-contact signal box which has proved satisfactory through several years of hard service is shown in the accompanying illustration. The device consists of a fixed block nailed to the top of an inclosing box and a movable handle extending through the end of the box. The block and handle are connected by a butt hinge. Brass plates for making contact are screwed to both the block and the handle. Soldered to the side of each brass plate



Gravity-Release Electric Signal Box

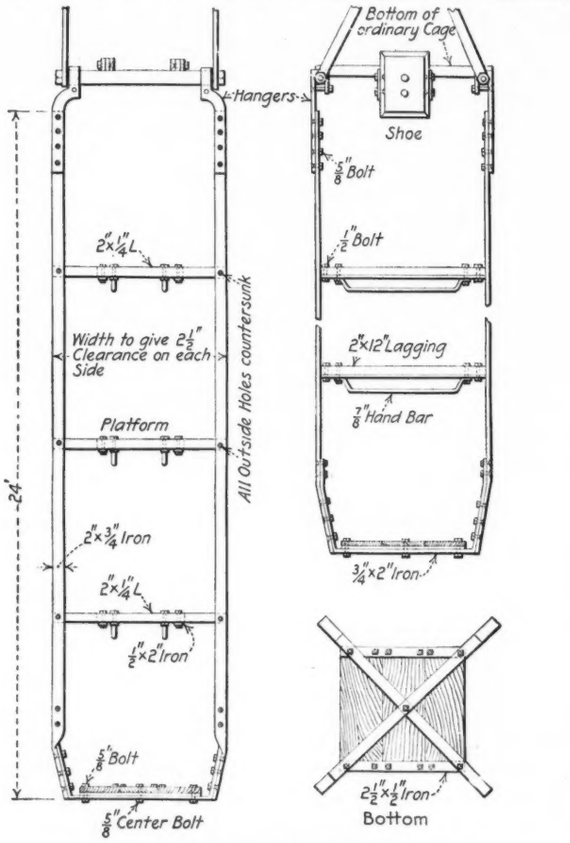
is a wire connecting with the bell line. The handle must be lifted to make a contact and give a signal. The contact made, the handle naturally drops to the open position without further attention. Ordinarily the boxes are unpainted but in unusually wet places a coat of paint and a shield which moves with the handle and covers the handle opening into the box make for increased efficiency. These boxes have worked well in wet stations.

*Mining engineer, Ducktown, Tenn.

Four-Deck Shaft-Repair Cage

By Albert B. Pedersen*

The illustration shows a 24-ft. cage with four decks used by the Chief Consolidated Mining Co. at Eureka,



Four-Deck Shaft-Repair Cage

Utah, for changing guides from 3½x3½ in. to 3½x7 in. After this work was done shoes were put on the bottom and the cage was used for regular shaft inspection and repair work. The long cage was swung from the bottom of the ordinary cage by means of the hangers at the top. The cage corners were made of 2x¾-in. strap iron; 2x¼-in. angles attached to the corner irons supported wooden platforms; to the bottoms of these were bolted hand bars of ⅞-in. round iron. The bottom was made tapered as shown.

Using this cage with one man on each deck, about 200 ft. of guides was changed on an average in eight hours.

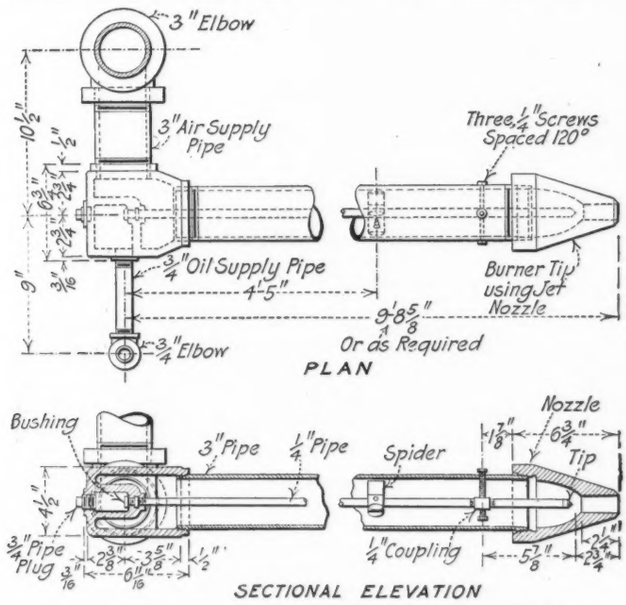
A Duty of 6.02 Cu.yd. Per Miner's Inch of water was obtained in the hydraulicking operations of the Yukon Gold Co. in 1914. A total of 3,241,641 cu.yd. of gravel was hydraulicked for a yield of $544,262, or about 16.8c. per cu.yd. The working cost, exclusive of depreciation on the main ditch, was 7.6c. per cu.yd., a reduction of 2.1c. from the cost of the previous season.

*Box 356, Eureka, Utah.

Details of Milling and Smelting

Low-Pressure Oil Burners at Steptoe

The low-pressure burners used on the reverberatory furnaces of the Steptoe Valley Smelting & Mining Co., at McGill, Nev., are shown in the accompanying illustration. In describing[1] the practice at this plant, R. E. H. Pomeroy states that the air for these burners is supplied at only 40-oz. pressure by a motor-driven Connersville blower of 42-cu.ft. capacity per revolution. The oil used is crude petroleum having a specific gravity of 16.5° Bé., flashing in open test at 199° F. The oil is heated to about 200° F. in a steam heater before going to the furnace, about nine boiler horsepower per furnace-day being required to heat the oil from the line temperature to the burning tempera-



Low-Pressure Oil Burners—Steptoe Type

ture. The oil is fed by gravity (34 lb., static pressure) through seven burners.

The No. 2 reverberatory furnace, on which a series of tests were made, has the following dimensions at the skimming line: Length, 132 ft. ½ in.; average width, 18 ft. 10 in. The air supplied to the burners for atomizing and burning the oil amounts to about 10% of the theoretical air necessary for complete combustion, the remainder of the necessary air enters the furnace through the burner openings in the firing wall. No checker holes are provided and the charge holes in the roof are equipped with slide gates and "dog houses" to minimize air leakages. The combustion of the fuel is practically complete, the carbon monoxide in the effluent gases being less than 0.5%. The draft at the firing end of the furnace is 0.18 in. of water; in the uptake above the verb the draft is about 1 in., and in the stack 1.4 in. The top of the stack is about 320 ft. above the skimming line of the furnace.

[1]"Bull. of A. I. M. E.," February, 1915.

Successful Roll Operation

By James Humes*

The idea of a fleeting roll is one which has long been held by mine and mill operators. H. Kenyon Burch experimented largely on this subject, but did not attain commercial success.

Operators and users of grinding machinery should pass a vote of thanks to the Traylor Engineering & Manufacturing Co. for its accomplishment in bringing the crushing roll to its present state as a dependable machine for medium-fine grinding, either wet or dry, to 16 or 20 mesh. The design of the roll is such that it no longer requires the constant attention of an expert to keep it in operating condition.

To fully value the superiority of this type of roll it is only necessary to see it operating beside the usual standard machine. The operator should consider carefully the improvements in construction. The automatic lateral-adjusting or fleeting device, which is no longer an experiment, is unique, and every mechanical defect has apparently been removed. At the same time developments have greatly simplified the speed-shifting device, which has been so timed that the fixed roll moves over and back once in 30 min.

At the Silver King Coalition mill a type "A," 30x16-roll has been in constant operation for nearly two years, and is used for regrinding ½-in. jig middlings and tailings down to a fineness of 2 mm. at the rate of 9 tons per hr. The gangue consists of a hard, tough quartz, upon which a set of rolled-steel tires last about 90 days. The tires have shown no signs of corrugations or flanges. In fact, although they are run until worn down to a thickness of ½ in., they are nearly as smooth when worn out as when put in commission.

It is well known that the crushing efficiency of rolls depends on the condition of the tires and their smoothness. But operators have met with difficulty in securing the services of men who will see to the shifting by hand often enough to prevent corrugation. The automatic adjustment accomplishes this perfectly and requires no attention on the part of the operator. After nearly two years' operation the rolls to which I am referring seems to be in excellent condition. The bearings are large and well protected and show but slight signs of wear.

Adjustment once in 16 hr. is necessary to compensate for wear, but the method used for tightening up makes it a matter of ease and simplicity. The tension rods are geared together, there being a machined wormwheel on each. These two wormwheels are connected by means of a shaft and gear meshing into them so that the turning of the shaft will open and close the roll as desired. This is an exceedingly important matter, since it prevents getting the roll shafts out of parallel.

The fixed-roll shaft is controlled laterally by the auto-

*Superintendent, Silver King Coalition mill, Park City, Utah.

matic adjusting device, and the movable shaft is controlled by collars turned on the end of the shaft, making them an integral part of the shaft. These collars are engaged by a bronze bearing on the inside of the housing of the main-roll bearing. The method of construction protects the collars and insures perfect lubrication. It also eliminates all danger of a collar catching an operator, and avoids delays or shut-downs for adjustment.

There have been considerable discussion and some doubt in the minds of engineers as to the success and dependability of the fleeting device on rolls, and whether such device would prevent flanging and corrugating of the tires. This can now be answered in the affirmative, as the Silver King rolls have never shown any signs of corrugation or flanging. It is important that, in using rolls equipped with the fleeting device, the lateral movement of the shaft should be in proportion to the size of rock to be crushed. It is well known that coarse ore makes wide corrugations and fine ore proportionately narrow ones. A lateral movement, therefore, to prevent corrugation must be of a length not less than 65% of the distance from apex to apex of the corrugation formed.

With these rolls the following points of superiority have been demonstrated: The cost of upkeep is less than for our other type of rolls, or Huntington mills; power required is less; there is a saving of one man's labor on each shift, and most important is the difference in recovery from the material treated by them. This difference amounts to 0.1% lead and 1 oz. of silver per ton. As the product amounts to 9 tons per hr., it will be clearly understood why I am taking the trouble to place this matter before those who are striving to do the best possible work in saving values.

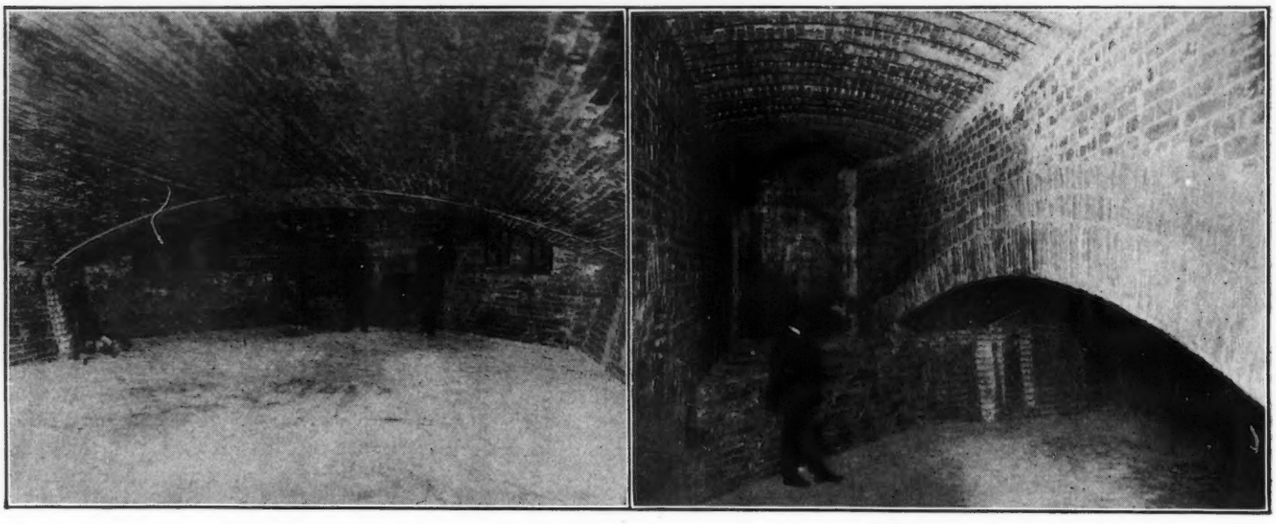
Reducing Camshaft Vibration

For reducing the vibration of camshafts with heavy stamps when the two shafts come together, as in a 10-stamp battery, success has followed the use of a wrought-iron ring 1½ in. wide and ½ in. thick, the inside of which was bored out $^1/_{64}$ in. larger than the diameter of the camshaft. This ring has two oil holes with a spiral groove for lubricating. The camshaft boxes are turned out to fit the ring.

The ring acts like a sleeve joining the two shafts, loose and free to turn in either direction, the shafts also being free to run independently. When either shaft has a tendency to lift, the weight of the other, connected by the loose collar, holds it down. In this way most of the vibrations are eliminated.

Interior of Anaconda Reverberatory

The accompanying photographs show two interior views of the skimming end of the No. 6 reverberatory furnace at Anaconda. These photographs were taken at the Washoe reduction works on Mar. 18, 1915, and show some of the details of construction embodied in the recent remodeling of the Anaconda reverberatories for coal-dust firing. The increased tonnage smelted in the No. 8 and No. 5 furnaces, which were first remodeled for coal-dust firing, has resulted in the decision to remodel all of the reverberatories for this form of fuel. The furnaces have been lengthened and widened, as the fettling will be dropped through the roof instead of being thrown in through the side doors as heretofore. Most of the fettling will, of course, consist of the charge which is dropped along the side walls from openings left in the roof for the entire length of the furnace on both sides.



TWO VIEWS OF INTERIOR OF ANACONDA NO. 6 FURNACE—SKIMMING END

The Utilization of Exhaust Steam from simple noncondensing engines may make up a power deficiency that sometimes acts as a deterrent of further improvements. In the report of the St. Joseph Lead Co. it is noted that a low-pressure turbine, bought from the Doe Run company, was installed to utilize the exhaust steam from all the simple engines theretofore exhausting into the atmosphere at the smelting works at Herculaneum, Mo. A preliminary test made at the time of the report indicated that the new installation would be successful. The low-pressure turbine was expected to run the matte crusher, the limerock crusher, the baghouse, the Wedge roaster, the Holthoff roaster and the town lights from alternating current supplied by this low-pressure turbine, thus relieving the load on the direct-current generators. It may be mentioned in passing that the company moved a motor-generator set from Leadwood to Herculaneum to be used as a balancing set, in case more alternating current was generated than needed, and should the turbine be shut down for any reason, this set can be reversed and alternating current supplied from it to take care of the baghouse motors and other equipment ordinarily supplied by the turbine.

Company Reports

Osceola Consolidated

The Osceola Consolidated Mining Co., Houghton, Mich., reports a production of 14,970,737 lb. of copper for 1914, which was sold for an average of 13.14c. per lb., making total receipts $1,967,725. Expenses were $1,615,139 and consisted of $1,425,205 for mining, milling and transportation, $21,109 for construction, $167,734 for smelting, freight, commissions, etc., and $1091 for interest. The net profit for the year was $352,786, and dividend payments totaled $288,450, leaving $64,136 to be added to surplus. Total dividends to date amount to $12,179,675.

There were 1,136,118 tons of rock hoisted, of which 2.436%, or 27,671 tons, were discarded as waste. The mill treated 1,108,447 tons yielding 20,997,900 lb. of mineral which yielded 71.296% refined copper. This is equal to a yield of 13.5 lb. of refined copper per ton of rock treated. The following table gives a comparison of costs for the last four years:

	1911	1912	1913	1914
Tons rock treated	1,246,596	1,246,557	735,044	1,108,447
Yield, lb. of refined copper per ton	14.8	14.8	15.4	13.5
Cost per lb. copper:				
Mining, milling and transporting	(a) 7.73c.	(b) 8.34c.	(c) 10.39c.	9.52c.
Construction	0.49c.	0.95c.	0.77c.	0.14c.
Smelting, freight, commissions, etc.	1.06c.	1.07c.	1.14c.	1.12c.
Interest	...	...	...	0.01
Total cost per lb. copper	9.28c.	10.36c.	12.30c.	10.79c.
Development included in above costs:				
Shafts, ft.	306	59	88	255
Openings, ft.	6738	7071	4591	4581

(a) 63,449 tons North Kearsarge ore stamped at a cost of 27.28c. per ton.
(b) 77,937 tons North Kearsarge ore stamped at a cost of 24.32c. per ton.
(c) 13,339 tons North Kearsarge ore stamped at a cost of 27.88c. per ton.

On Sept. 1 wages were reduced about 10% and salaries 15% and the mine operated on a three-quarters time basis. On Feb. 1, 1915, the North and South Kearsarge went back on full time. Full time was resumed on the Osceola branch in December at a reduced scale of wages, and on Feb. 1, 1915, the wages were increased to rates existing before the cut in December.

Temiskaming

The report of the Temiskaming Mining Co., Cobalt, Ont., shows an operating profit of $81,422 for 1914. Earnings from ore amounted to $144,399 and other earnings brought the total up to $146,649. Operating expenses aggregated $288,071. After charging off depreciation the total debit for the year was $105,169. The property was closed down in August on account of an attempt to reduce the scale of wages to conform with the wage scale of the camp. Operations were resumed in October at the reduced scale of wages, but owing to conditions brought on by the European war only partial operations were resumed. The company is now practically under the same management as the Beaver Consolidated, which adjoins it, and a system of inspection and sanitation has been introduced similar to the one which has been in force at the Beaver. Some work is being done through the Beaver property to follow an oreshoot into the Temiskaming property. Apparently this work has proven the extension of the orebody, and it is stated that a number of tons of 4000- to 10,000-oz. ore have been extracted. The vein has been drifted on for 60 ft. and is about 4 to 5 in. wide.

The mill-ore reserve is now being added to and was estimated to contain 5000 tons at the end of the year. The new management has stopped certain undertakings of the former management to develop the North Dome and the Duchess properties. It will acquire the North Dome company by a court sale and through the fact that it is the largest creditor of the North Dome Mining Company.

National Lead

The National Lead Co. of New Jersey reports net earnings of $2,476,293 for 1914, after deducting maintenance, repairs, etc. It paid $2,325,394 in dividends, of which $619,662 was on common stock. An analysis of the figures given in the report shows that the balance of receipts over all expenditures was $2,092,976, or $232,418 less than dividend payments, which balances with the decrease shown in quick assets on hand. The profit therefore as stated was disbursed as follows: $2,092,976 toward dividends, $240,614 in plant investment and $142,703 in other investments; total profit for the year, $2,476,293. The balance of quick assets over current liabilities at the end of the year was $10,642,723, of which $7,164,475 was in stock on hand. It is stated that only the cost of new plants is added to the plant account.

There were 6859 stockholders on the books at the close of the year and of this number 48% were women. The products of the company consists of painters' materials, bearing metals, plumbers' materials, printers' metals, canners' materials, lead oxides, sheet lead, glaziers' lead, bar lead, lead wire, lead sash weights, piano-key leads, brown sugar of lead, white sugar of lead, linseed-oil cake and meal and castor oil. The company is continuing its policy of safeguarding the health of its employees, giving compensation for injuries and maintaining a pension system for aged employees.

Brunswick Consolidated

The Brunswick Consolidated Gold Mining Co., Grass Valley, Calif., in its report for year ended Jan. 28, 1915, states that the results during 1914 were better than in any previous year. The total production was $288,391 from 16,237 tons of ore, or at the rate of $17.76 per ton. The expenditures were $165,956, so that the net realization was $122,435. Adding income from other sources, total profits for the year were $123,964. Dividend payments for the period aggregated $94,868, making a total of $132,163 to date. The cost figures include expenditures for improvements and repairs, $22,966 for new shaft and

over $20,000 for unproductive development work. Development work totaled 2702 ft. The new shaft was sunk 240 ft. deeper at a cost of $91.94 per linear ft.

The average extraction at the mill was 93.9% and the average milling cost was 92.6c. per ton, including 34c. per ton for freight and treatment of bullion and concentrates. Concentrates produced amounted to 288 tons and the cost of treating them, including an 8% loss in value, was $16.61 per ton. It is estimated that a saving of $9 per ton could be made by cyaniding these concentrates, and the erection of a plant to cost about $5000 is contemplated for this purpose. The stamp duty was 0.0965 tons per hr. and 14,756 oz. of quicksilver were fed to the batteries, which was equal to about 1 oz. per 1.1 tons of ore. The value of bullion recovered per ounce of quick amounted to $18.21. The total cost per ton was $10.221, made up as follows: Mining, $6.053; milling, 92.6c.; new shaft, $1.359; repairs, 18.1c.; improvements, 40.8c.; and general expenses, $1.294 per ton.

Homestake Mining Co.

According to the annual report of the Homestake Mining Co., operating at Lead, S. D., the property during 1914 produced the greatest tonnage of ore in its history. There were milled in that period 1,587,774 tons for a bullion yield of $6,160,161, or an average of $3.88 per ton. Compared with the previous year the bullion yield and average value were lower; in 1913 1,540,961 tons yielded $6,186,652, an average of $4.01 per ton. Dividends during 1914 were the greatest in the mine's history, totaling $2,210,208, against $2,146,225 the previous year.

Richard Blackstone, superintendent, reports that the operations of the company for 1914 have been normal, there being no interruption to continuous operation.

The principal betterments consist of a completely equipped central boiler plant of six 600-hp. boilers; an electric generating station having a maximum capacity of 4000 kv.-a., consisting of two units of steam turbines, condensing, direct connected to generators; a compound condensing steam hoist, designed to handle two 6-ton skips from a maximum depth of 4000 ft., skips dumping direct into two No. 8 Gates crushers, and a compound condensing air compressor with a capacity of 3000 cu.ft. free air.

The B. & M. shaft was sunk from the 1550-ft. level to the 1700-ft. level and the Golden Star shaft from the 1250-ft. level to the 1400-ft. level, while 17,809 ft. of drifting was done during the year.

Receipts of the company for the year are given at $7,736,970, including the bullion as above, a balance of $1,428,248 carried forward from the previous year; sales of quicksilver, $17.75; blacksmith-shop labor, $1363; discount and interest, $42,114; foundry castings, $96,836; candles, $5281; sundry sales of material, $523; and wood, $2425. Disbursements totaled $6,839,374, leaving a balance to be carried forward of $897,595.

The report does not give unit costs, but the various items are about as follows:

	Total	Per Ton
Mining	$2,792,330.19	$1.759
Stamp milling	597,326.99	0.376
Regrinding	24,288.68	0.015
Cyaniding	294,547.51	0.185
General expense	501,233.23	0.315
	$4,209,726.60	$2.650

In addition to expenditures which have been considered in computing the above costs, there was expended for construction of steam-electric power plant, $81,263, central steam plant, $117,364, and recreation hall, $110,629; expenditures of $13,652 for aid fund, $2800 for benefices; $10,234 and $83,498 for timber lands were also in addition to above table of costs.

Nevada Hills

The Nevada Hills Mining Co., Fairview, Nev., reports a production of 64,348 tons of ore in 1914, averaging $7.86 per ton, or a total gross contents amounting to $505,798. The mill recovered 88.8%, or $6.98 per ton, making total receipts from ore $449,239. Miscellaneous earnings were $12,033. The net profit for the year, not including depreciation, was $67,036. A summary of the costs per ton follows:

		Total per Ton
Mining:		
Development	$0.758	
Stoping	1.733	
Dump ore	0.203	
Total mining (labor, $1.7333; supplies, 75.8c.; power, 20.3c.)		$2.694
Milling:		
Labor	$0.721	
Supplies	1.081	
Power	0.440	
Total milling		2.242
Marketing:		
Concentrates	$0.313	
Cyanide bullion	0.121	
Slag	0.002	
Total marketing		0.436
General expenses		0.405
Property tax		0.044
Bullion tax		0.021
Income tax for 1912-1913		0.058
Old litigation settled		0.043
Current construction charged to operations		0.005
Ore purchased		0.179
Total		$6.127
Net recovery from ore		6.981
Profit from ore		$0.854
Miscellaneous		0.187
Total profit per ton of ore		$1.041

Development aggregated 5697 ft. and the detailed costs show that the average cost of drifting and crosscutting was $8.15 per ft.; of raises, $6.30; of winzes, $15.27; and of shaft sinking, $62.48 per ft. The milling capacity was increased from 145 tons to 200 tons per day and the average treated during the year was 176 tons per day.

Ore reserves are estimated to contain about a seven months' supply, or about 40,000 tons, but the margin of profit is expected to be less than $1 per ton. The property produced about 600,000 oz. of silver during 1914 which sold for about 6c. less than the price received during 1913.

Winona Copper Co.

The Winona Copper Co., Houghton, Mich., showed net assets over liabilities on Jan. 1, 1915, of $92,649, of which $37,462 consisted of unpaid assessments. Rock stamped in 1914 amounted to 123,339 tons, from which 2,239,170 lb. of mineral was produced. This, when refined, yielded 1,352,084 lb. of copper. This is equivalent to 18.15 lb. of mineral and 10.96 lb. of copper per ton of rock stamped. There were 771,442 lb. of copper sold at 14.2c. per lb., and 580,643 lb. remained unsold. The mine was shut down in August, after reaching the greatest monthly output in its existence in July, and remained closed until October, when 35 of the best workmen resumed work on a tributing arrangement, by which the company receives 50% of the returns over the wages.

Correspondence and Discussion

Pine Oil Supply for Flotation Concentration

We note in the JOURNAL of Mar. 6, p. 462, an editorial on "Flotation Oils." We believe that the estimate of the amount of pine oil is high. At the present time there is not produced in the United States in the form of steam pine oil, which is considered a high-class flotation medium, in excess of 200,000 gal. per annum, and not so much of what is known as destructively distilled pine oil. In my opinion these figures are high and the facts probably are that there is not within 75% of the above amounts produced at the present time. By this we mean the material which is commercially known as pine oil. As the JOURNAL correctly says, however, there is not and would not be a scarcity of pine-tar oils, which can be produced in much larger quantity and materially cheaper. We believe, however, it would be safe to say that were three or four of the largest mines of the country to use flotation processes on all of their ores, adopting steam pine oil as a suitable material, they could not get enough to take care of their requirements.

I made an extensive trip last summer through the entire West and made a point of emphasizing these facts. For your information I wish to say that few if any of the people who have made pine oil have even done so profitably by the methods used in the past, and of the resinous constituents of our fat pine but about 3% is pine oil.

PENSACOLA TAR & TURPENTINE CO.,
F. E. MARINER, President.

Gull Point, Fla., Mar. 16, 1915.

Do We Want Mexico?

"Do we want Mexico?" is the dominant note of many a conversation inspired by the policy of "watchful waiting." Answers to this question range from the shocked and peace-at-any-price attitude of the 1845 Horace Greeley type, through the Daniel Websterian disdainful contempt for all things Western, to the rampant braggadocio of the land-grabbing jingo element as personified by pseudo-Texans.

But let me give you what should be the firm and unhesitating answer of the mining engineer and his brother the prospector. We want Mexico! Yes, we want Mexico. We want Mexico peaceful or peacefully. We want Mexico happy or happily for all concerned. But we want Mexico honestly governed under the Constitution of 1857 and the laws of Mexico. The laws are excellent, and the mining laws are in very many respects better than our own. But we want Mexico to have a square deal from all the world, and particularly from the Mexicans themselves.

If at length we find Mexico in the position of a family of our neighbors, where the adult parents have fought to the death and have left a brood of helpless and ignorant children to play with the weapons which made them orphans, then we may still wait watchfully. Our position is not that of a landlord. We may have furnished some of their household goods on credit, with some of the installment payments now overdue. If so, our rights must be protected—must and shall be protected; but always in a legal manner.

If we see in control an element comparable to the *serape*-clad toiler whose drudgery provided the sustenance of the family in *tortilla* days, we should pause a moment. Then we may extend our hand, not in anger, but rather as a kind-hearted creditor who proffers assistance in restoring the furniture to its accustomed place and in making proper arrangements for educating the children of the disordered household. We want Mexico to put its house in order. Incidentally, we do not relish having any holes punched, kicked, cut or shot through the walls of our own house.

WILLIAM B. MCKINLAY.

New York, Mar. 24, 1915.

Copper Output of Gatico Company

No. 2 of Vol. 99 of the JOURNAL arrived here safely this week and its contents were perused with much pleasure, giving as it does, so early in the year, the approximate production of the metals of the world for 1914. I am curious to know why the Gatico company and smeltery are not mentioned in the review of Chilean mining on p. 129, for the production of that company has steadily increased for many years past, and while it is still by no means a large producer, when compared with the large copper mines in the United States, it produced last year 2,414,506 kg. of converter bars containing 98.5 and 99.5% Cu, or approximately 6% of the total copper produced in Chile as given on p. 51 of the same JOURNAL, and more than at least one of the companies mentioned on p. 129. The Gatico company produced more in the last half than it did in the first half of 1914, and is probably in the first hundred copper mines of the world, giving them rank by a comparison of their productions for last year.

GEORGE W. WATERS.

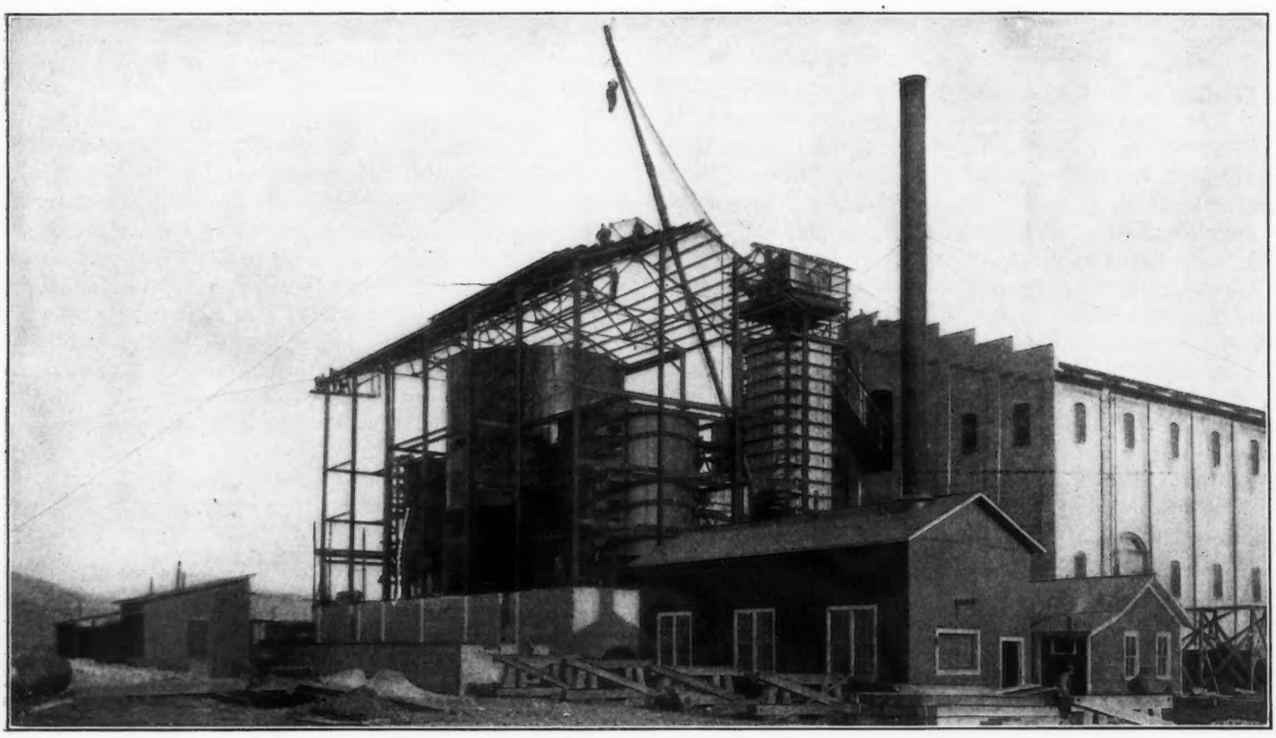
Santiago, Chile, Feb. 11, 1915.

[No mention was made of the operations of the Cia. de Minas de Cobre de Gatico by any of our correspondents in Chile, and no reply was received to our own letter of inquiry to the company, hence the omission.—EDITOR.]

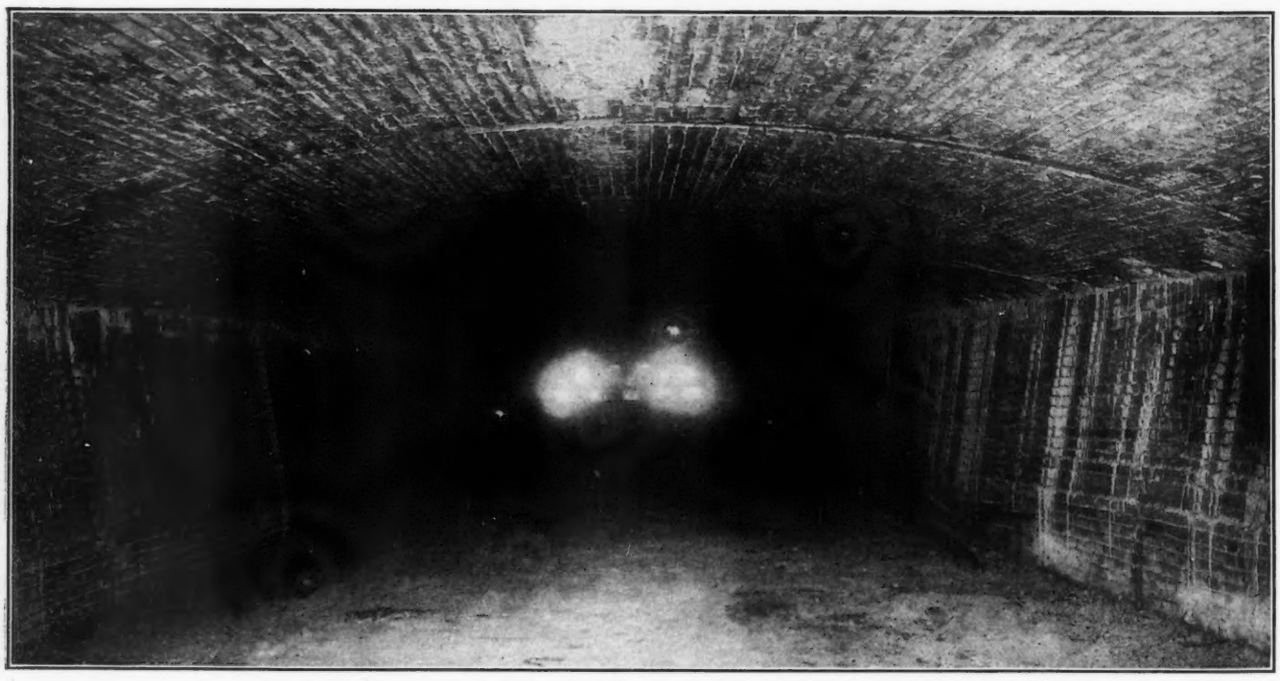
Hydro-Electric Plant at a Bolivian Tin Mine

Mark R. Lamb writes us that the article on a "Hydro-Electric Plant at a Bolivian Tin Mine," published under his name in the JOURNAL of Jan. 2, 1915, should have been credited to Oscar von Chrismar. The article was sent to us by Mr. Lamb and by an unfortunate misunderstanding in this office it was supposed to be his article. We regret the error.

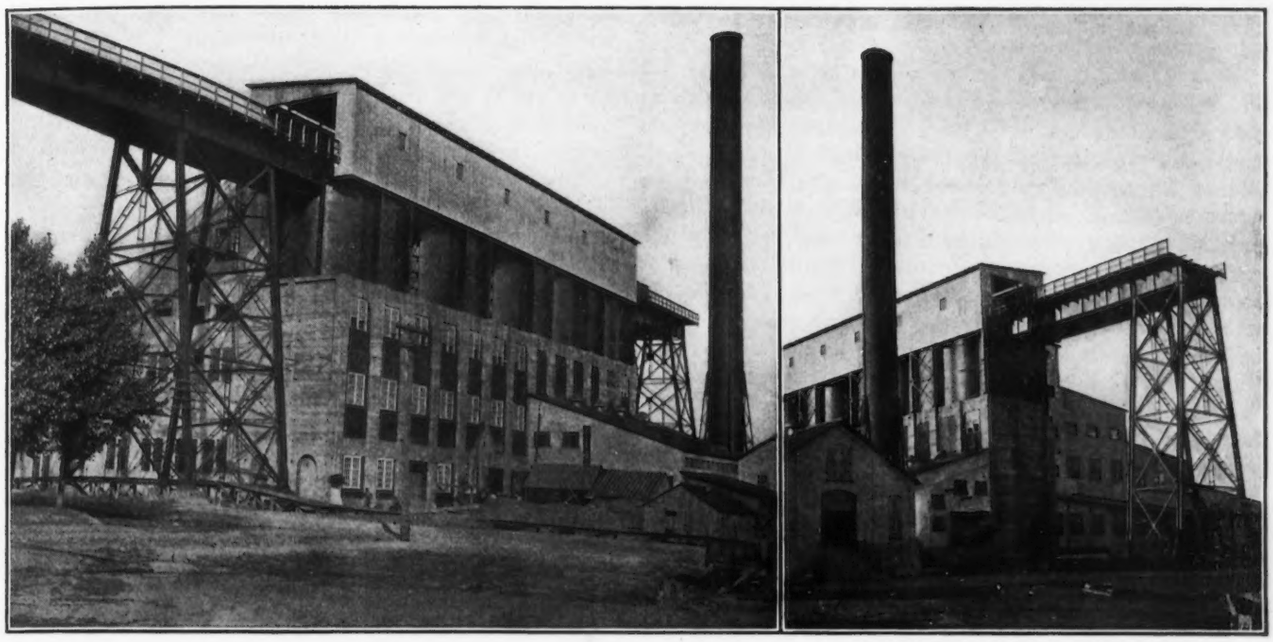
Photographs from the Field



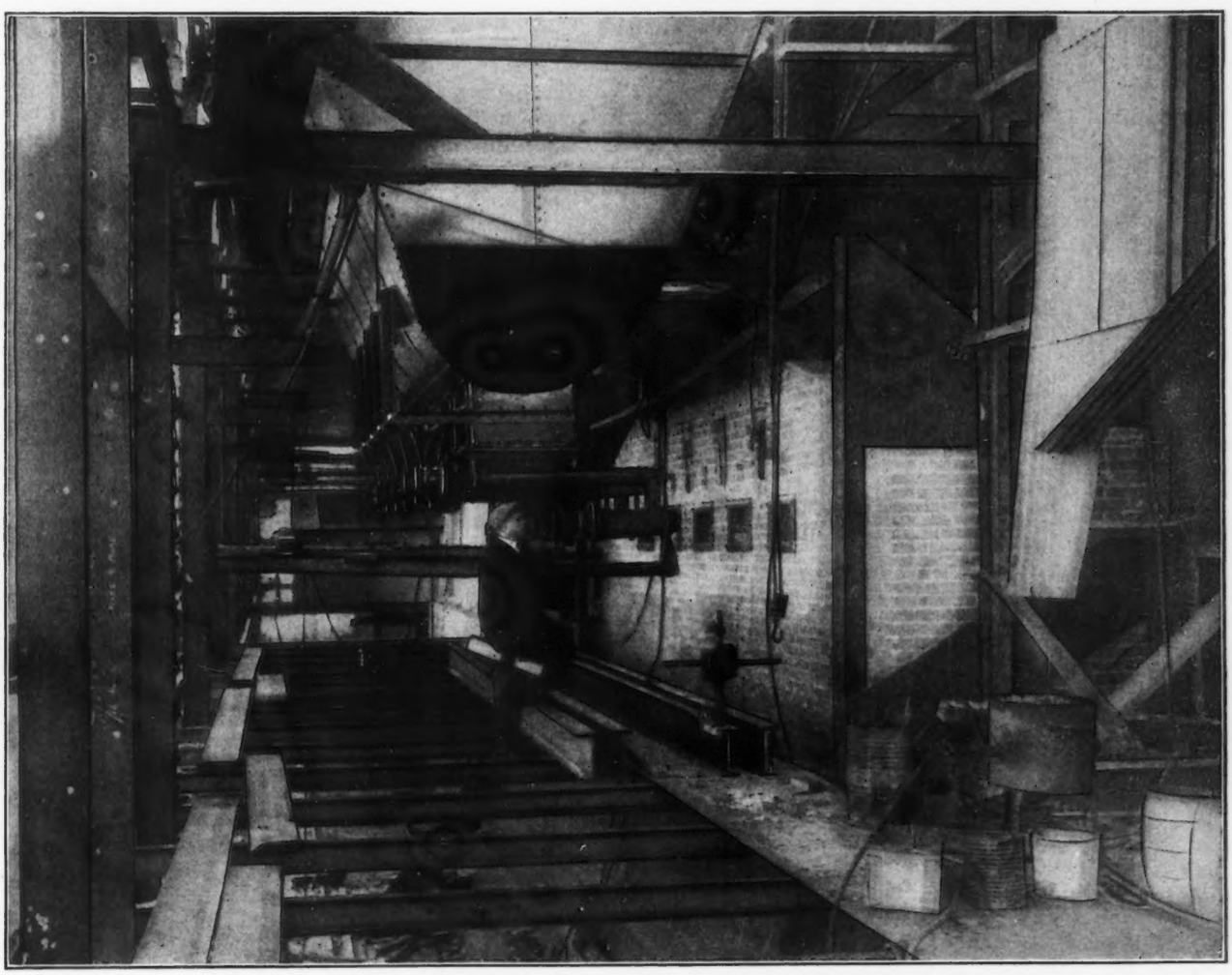
ANACONDA COPPER MINING CO.'S 100-TON ACID PLANT
Furnaces, dust catcher and Glover tower



INTERIOR OF NO. 5 REVERBERATORY OF ANACONDA COPPER MINING CO.
Looking toward the firing end



TWO VIEWS OF THE NEW AHMEEK COPPER MILL, MICH.



ANACONDA COPPER MINING CO.'S NO. 5 REVERBERATORY FURNACE
Coal-dust storage and burners

Second Pan-American Scientific Congress

The Second Pan-American Scientific Congress will be held in Washington, D. C., Dec. 27, 1915, to Jan. 8, 1916, under the auspices of the Government of the United States. The general purposes of the Congress are the presentation and discussion of matters of scientific interest, especially those that bear most directly on industrial progress, and the formation of personal acquaintances among representatives of the American republics, with the intent of increasing the exchange of knowledge and bringing about a better understanding of the ways in which the several republics can work to the advancement of science and the promotion of trade, commerce and mutual helpfulness. The Congress will be divided into sections, as follows:

I. Anthropology.
II. Astronomy, Meteorolgy, and Seismology.
III. Conservation of Natural Resources, Agriculture, Irrigation, and Forestry.
IV. Education.
V. Engineering.
VI. International Law, Public Law, and Jurisprudence.
VII. Mining and Metallurgy, Economic Geology, and Applied Chemistry.
VIII. Public Health and Medical Science.
IX. Transportation, Commerce, Finance, and Taxation.

Section VII, Mining and Metallurgy, Economic Geology, and Applied Chemistry, will consider especially the mineral resources of the several republics, the methods by which these resources can be developed and used and the manifold applications of chemistry in the production and utilization of materials of benefit to man, as set forth in the preliminary program issued by the Executive Committee of the Congress.

To facilitate the preparation, assembling, and presentation of papers, committee members have been appointed for the section as follows: Hennen Jennings, mining engineer, Washington, D. C., member of the Executive Committee of the Congress, president; John Barrett, director-general of the Pan-American Union, secretary-general of the Congress, member ex-officio; S. Sanford, mining engineer and editor, U. S. Bureau of Mines, Washington, D. C., recorder.

Mining

Dr. J. A. Holmes, director of the U. S. Bureau of Mines, Washington, D. C., chairman; J. F. Callbreath, secretary of the American Mining Congress, Washington, D. C.; Dr. C. H. Lindley, lawyer, authority on mining law, San Francisco, Calif.; E. W. Parker, statistician, Mineral Resources of the United States, U. S. Geological Survey, Washington, D. C.; H. C. Perkins, mining engineer, Washington, D. C.; G. S. Rice, chief mining engineer of the U. S. Bureau of Mines, Pittsburgh, Penn.; W. L. Saunders, engineer, president of the American Institute of Mining Engineers, New York; B. B. Thayer, past president of the American Institute of Mining Engineers, New York.

Metallurgy

W. R. Ingalls, president of the Mining and Metallurgical Society of America and editor of the Engineering and Mining Journal, New York, chairman; Dr. F. G. Cottrell, chief chemist of the U. S. Bureau of Mines, San Francisco, Calif.; Dr. R. H. Richards, professor emeritus of Mining Engineering and Metallurgy, Massachusetts Institute of Technology, Boston, Mass.; former president of the American Institute of Mining Engineers; Bradley Stoughton, metallurgical engineer, secretary of the American Institute of Mining Engineers, New York; Dr. L. D. Ricketts, mining and metallurgical engineer, New York, N. Y.; Karl Eilers, metallurgical engineer, New York; W. R. Walker, metallurgist, New York; Dr. G. H. Clevenger, Professor of Metallurgy, Stanford University, Calif.

Economic Geology

Dr. Geo. Otis Smith, director of the U. S. Geological Survey, Washington, D. C., chairman; Dr. J. C. Branner, president of Stanford University, Calif., former president of the Geological Society of America; Dr. J. F. Kemp, professor of geology, Columbia University, New York, former president of the American Institute of Mining Engineers; Waldemar Lindgren, professor of economic geology, Massachusetts Institute of Technology, Boston, Mass.; C. R. Van Hise, president of the University of Wisconsin, Madison, Wis., former president of the Geological Society of America; David White, chief geologist of the U. S. Geological Survey, Washington, D. C.; Dr. I. C. White, state geologist of West Virginia, Morgantown, W. Va., formerly chief of the Brazilian Coal Commission; Dr. Bailey Willis, consulting geologist to the Argentine Government, geologist, U. S. Geological Survey, Washington, D. C.

Applied Chemistry

Dr. Charles E. Monroe, authority on explosives, dean of graduate studies, George Washington University, Washington, D. C., former president of the American Chemical Society, chairman; Dr. Carl L. Alsberg, Chief of the Bureau of Chemistry, Department of Agriculture, Washington, D. C.; Dr. C. H. Herty, President of the American Chemical Society, Chapel Hill, N. C.; Dr. B. C. Hesse, chemist, New York, N. Y.; Dr. W. F. Hillebrand, chief chemist of the U. S. Bureau of Standards, Washington, D. C., former president of the American Chemical Society; F. A. Lidbury, electrochemist, president of the American Electrochemical Society, Niagara Falls, N. Y.; Dr. P. C. McIlhiney, chemist, chairman of the New York Section, Society of Chemical Industry, New York, N. Y.; Dr. Harvey W. Wiley, chemist, former president of the American Chemical Society, Washington, D. C.

As shown in the preceding statement, John Barrett, Director-General of the Pan-American Union, Washington, D. C., has been appointed secretary-general of the Congress. The duties of the committee members will be to render such aid as they can in furthering the purposes of the Congress by contributing papers and participating in discussions. Suggestions regarding the preparation of papers and more explicit information on the organization and work of the Congress will be given in later notices.

New Rules for Bonded Smelters

After several months spent in preparation, the Treasury Department has promulgated elaborate regulations covering the establishment of bonded smelting and refining warehouses under subsection 1 of paragraph N of section 4 of the Tariff Act, according to Washington dispatches. Copies of the new regulations are being sent out to officers of the customs and to smelters throughout the country. Besides providing for the establishment of warehouses,

the rules make provision for entry for warehouse, materials, renewals of bond, discontinuance and other details relating to the receipt of ores or crude metals in bonded warehouses.

Among other things, it is provided that manufacturers engaged in smelting or refining or both shall immediately notify the Secretary of the Treasury regarding any material change in the character of the ore or base bullion processed. Manufacturers must also file with the Secretary an annual statement showing the quantities of ore and bullion on hand at the beginning of the period covered by the statement and the lead contents of the products. Representatives of the smelters who have seen the new regulations are of the opinion the rules call for much extra bookkeeping, with a corresponding increase in clerical hire.

Starting of White Pine Operations

HOUGHTON CORRESPONDENCE

On Apr. 15 the White Pine mill will be completed. From Apr. 15 until May 1 it will be running intermittently, testing out and adjusting the machinery. On May 1 the mill will go into regular commission. So May 1, 1915, will go down in the history of Lake Superior mining as marking the birth of the latest, one of the largest and in many respects the unique mine of the district. In one long jump, it extends the copper-producing section westward for a distance of over 15 miles from the Victoria mine, the next producing property to the east. It marks the first attempt at mining on a large scale along the western extension of the copper belt. It also marks the second attempt at mining copper from a sedimentary bed, the Calumet & Hecla being the first in mining the Calumet conglomerate.

FOUR OPENING SHAFTS

The White Pine mine is opened by four shafts, two of which are equipped with five-ton skips and will be the principal producing shafts. There are over 14,000 ft. of drifts opened up to date. The principal pay rock occurs in a zone between two faults that are parallel to the shales and sandstone. These two faults are about 19 ft. apart. Included between the faults are two beds of sandstone separated by a bed of shale. These two beds of sandstone are called veins No. 1 and No. 2. Vein No. 1 is about 6 ft. wide and is near the hanging. The shale bed between the two is often highly mineralized with native copper, in some places running as high as 4 to 5%. Vein No. 2 is about 8 ft. wide and is below the shale to the foot. As a usual thing vein No. 1 carries the higher values, at places running as high as 15%, or 300 lb. to the ton. At some places the mineralization extends through both veins and the included bed of shale. At other places the two sandstone beds and the included shale bed carry, relatively to the richer portion, but a small amount of copper. It is not these excessively rich portions and the relatively leaner portions that can be used to arrive at the value of the rock.

The White Pine ore averages 5% for a width of 8 ft. It will probably be rock of this grade that will go to the mill for the first three years and there is sufficient of it opened to date to supply the mill for this period. The copper values are not confined between the walls of the two principal faults but extend into the slate that forms the hanging of vein No. 1 and into the sandstone that forms the foot of vein No. 2. However, the copper values gradually diminish in a direct ratio to the distance into both the hanging and foot from the principal hanging- and foot-wall faults. Into the hanging-wall slate, at a distance of about 15 ft. from the hanging-wall fault, the copper values will diminish from about 30 lb. at the hanging-wall fault to about 12 lb. Into the foot wall the values will drop from about 30 lb. to the ton at the foot-wall fault to about 9 lb. in a distance of 10 ft.

A cross-section of the White Pine copper zone can be described as 15 ft. of copper-bearing slate in the hanging, with copper values starting at 12 lb. and increasing to 30 lb. at this hanging-wall fault; vein No. 1, 60 ft. wide, of exceptionally high copper values; 5 ft. of high-grade copper shale between veins Nos. 1 and 2; vein No. 2, 8 ft. wide, of copper-bearing sandstone, not so rich as vein No. 1, and in most cases not so rich as the included bed of shale; then 10 ft. of sandstone in the foot ending in copper values of about 9 lb. to the ton, giving a total width of copper-bearing rocks of 44 ft. The copper in the hanging-wall slate, the included shale between the two veins and in the foot-wall sandstone is of a much finer nature than the copper in veins Nos. 1 and 2.

Besides the two veins previously described there is another, known as vein No. 3, which lies into the foot wall at a distance of about 45 ft. at right angles to the bed from vein No. 2. This vein has been passed through in several crosscuts, and at each place where it has been cut it shows copper which will probably prove commercial after further development. Up to the present time no drifting has been done on vein No. 3. At the surface the dip is only 5°, increasing sharply from the second level until it reaches a maximum dip of 45° at the present bottom of the mine, which is 1100 ft. from the surface on the incline.

The recovery of copper will be at least 75%, and it is possible that it will reach 85%. The capacity of the mill is estimated at 1000 tons per day, but it will be operated at the rate of 500 tons daily for the first six months. If it is assumed that the rock will carry 4%, or 80 lb. to the ton, and that the recovery will be 75%, the daily output in copper will be 60,000 lb., or 18,000,000 lb. on a 300-day year when working normally. The rock is soft, cheap to mine and crush and the milling costs will be low; so this 18,000,000 lb. of copper should be made at a low cost.

Big Pine-Lake Superior & Western Consolidation

EDITORIAL CORRESPONDENCE

An interesting consolidation of two Arizona mining companies is being effected through the efforts of Herbert C. Shotwell, a mining engineer, of Prescott, Ariz. The companies consolidating are the Big Pine Mining Co. and the Lake Superior & Western Mining Co. The former company, with about 200 stockholders, was promoted in New York about six years ago. The latter, with about 1200 stockholders, was promoted in the Lake Superior region three years ago.

The Lake Superior & Western Mining Co. has spent about $250,000 on the Mascot mine near Crown King,

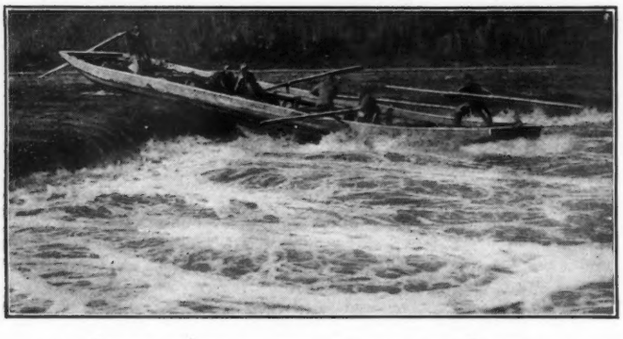
Ariz. A portion of this amount was spent for a 100-ton cyanide plant; but the ore supply proved to be of too low grade to pay. The Big Pine company, with property situated about 12 miles south of Prescott and about 50 miles from the Mascot mine, has been developing orebodies in a small way for the last six years. At present there is developed by adits, pits, raises and winzes about 48,000 tons of ore, having a gross value of $427,000. The ore occurs in a mineralized fracture in quartz diorite, having a width of from 3 to 4 ft. The content is gold, easily treated by cyaniding with a high percentage of extraction.

The consolidation will be effected as follows: The Big Pine Consolidated Mining Co. will be formed with a capital stock of 500,000 shares, $1 par value. Of this, 200,000 shares will be issued for the Big Pine properties and 200,000 shares to the Lake Superior & Western Co. for its mill and $32,150 in cash. The funds furnished are to be spent in installing the Lake Superior & Western mill on the Big Pine claims and doing further development work there. To finance this consolidation the Lake Superior & Western company has called an assessment of 10c. per share on its outstanding stock, which is now 50c. paid, the remainder being subject to call up to $1. This company also has outstanding bonds amounting to $136,000 which are held in small amounts by about 900 of its stockholders. The Lake Superior & Western company has a liberal contract and is given ample time in which to raise the funds required. The first payment on the contract has been made and work will soon be progressing rapidly at the Big Pine mine. Engineers have reported favorably on the latter property.

New Silver Discovery in Canada

SPECIAL CORRESPONDENCE

A persistent report of a silver strike that is said to be greater than Cobalt is causing much excitement in western Canada now. The situation of the discovery is said to be at Fond du Lac, a point at the northeastern end of Athabasca Lake, in northwestern Saskatchewan.



PROSPECTORS ON THE ATHABASCA RIVER

Large numbers of prospectors are now outfitting at Edmonton and other points, intending to make the trip as soon as the ice on the lakes and rivers goes out, which will probably be in the fore part of April, about a month earlier than usual, due to the mild winter. The accompanying photograph shows a party of prospectors *en route* for the silver country. They left early last fall. The illustration gives an idea of the rough water likely to be encountered in the trip down the Athabasca River.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUMINUM—Treatment of Aluminum to Render It Unalterable. Francesco Pucillo, Genoa, Italy. (U. S. No. 1,130,196; Mar. 2, 1915.)

ALUMINUM ALLOY. Alfred Wilm, Schlachtensee, near Berlin, Germany. (U. S. No. 1,130,785; Mar. 9, 1915.)

AMALGAMATING MACHINE. William Carson, Sydney, N. S. W., Australia. (U. S. No. 1,128,847; Feb. 16, 1915.)

AMALGAMATOR—Agitating Electric Amalgamator. Leon St. D. Roylance, San Francisco, Calif. (U. S. No. 1,128,905; Feb. 16, 1915.)

COPPER AND NICKEL—Process of Circulating Solution for Electrolysis. Noak Victor Hybinette, Christiania, Norway, assignor to Pacific Securities Co., Ltd., Toronto, Canada. (U. S. No. 1,128,315; Feb. 16, 1915.)

CRUSHER—Gyratory Crusher. Thomas L. Smith, Milwaukee, Wis. (U. S. No. 1,132,984; Mar. 23, 1915.)

CRUSHING—Ring-Roll Crusher and Pulverizer. Henry J. Shelton, St. Louis, Mo. (U. S. No. 1,132,042; Mar. 16, 1915.)

DRILL BIT. George Watson McAllister, San Francisco, Calif. (U. S. No. 1,133,161, and 1,133,162; Mar. 23, 1915.)

DRILLING—Direction-Indicating Attachment for Drilling Machines. Roy Addison Bowen, Commonwealth, Wis. (U. S. No. 1,131,596; Mar. 9, 1915.)

DRILLING—Dust Collector for Rock Drills. Emmet F. Galligan, Idaho Springs, Colo., assignor of one-half to Henry E. Woodward, Denver, Colo., and one-fourth to William H. Galligan, Idaho Springs, Colo. (U. S. Nos. 1,128,437; 1,128,674; and 1,128,675—Feb. 16 1915; and 1,131,052, Mar. 9, 1915.)

DRILLING—Dust Collector for Rock Drills. Frank Rylander, Dumont, Colo. (U. S. No. 1,131,009; Mar. 9, 1915.)

ELECTRIC FURNACE. John Blatchford, Oak Park, Ill. (U. S. No. 1,129,842; Mar. 2, 1915.)

ELECTRIC FURNACES—Process of Cooling Electric Furnaces by Air. Henri Magron Fos, Haute-Garonne, France. (U. S. No. 1,131,609; Mar. 9, 1915.)

ELECTRIC ZINC FURNACE with Integral Condenser. Charles Victor Thierry and Michel Thierry, Paris, France. (U. S. Nos. 1,122,663; and 1,122,664; Dec. 29, 1914.)

FERTILIZERS—Process of Separating Phosphorus from Its Phosphate Combinations. Samuel Peacock, Chicago, Ill., assignor to International Agricultural Corporation, New York, N. Y. (U. S. No. 1,129,504; Feb. 23, 1915.)

FURNACE GRATE. Thomas M. Kekich, Chicago, Ill. (U. S. No. 1,131,524; Mar. 9, 1915.)

HOISTING—Controlling Device for Hoisting Engines. Sven T. Nelson, Chicago, Ill. (U. S. No. 1,129,045; Feb. 16, 1915.)

HOISTING BUCKET. Daniel B. Youngblood, Charlotte, Mich. (U. S. No. 1,128,397; Feb. 16, 1915.)

HYDRAULIC SEPARATOR for Phosphate Rock. Frank K. Hoover and Arthur J. Mason, Chicago, Ill. (U. S. No. 1,128,875; Feb. 16, 1915.)

IRON ALLOY. Walter Rübel, Charlottenburg, Germany. (U. S. No. 1,128,726; Feb. 16, 1915.)

IRON-ORE REDUCTION—Fuel-Briquet Composition for Iron-Ore Reduction. William Loesch, Chicago, Ill., assignor of forty one-hundredths to George B. Storer, Chicago, Ill. (U. S. No. 1,131,531; Mar. 9, 1915.)

JIG. John H. Magee, Carthage, Mo. (U. S. No. 1,128,807; Feb. 16, 1915.)

MINER'S CANDLESTICK. Theodore D. Lance, Butte, Mont. (U. S. No. 1,131,528; Mar. 9, 1915.)

ORE TREATMENT—Process for Treatment of Precious-Metal Ores for Extracting Their Values. Edward L. Dufourcq, New York, N. Y. (U. S. No. 1,133,110; Mar. 23, 1915.)

PHOSPHATE ROCK—Process of Treating Natural Phosphate Rock. Frank K. Hoover and Arthur J. Mason, Chicago, Ill. (U. S. No. 1,128,874; Feb. 16, 1915.)

POTASH RECOVERY from Natural Silicates. A series of patents on this subject, granted to Samuel Peacock, Chicago, Ill., assignor to International Agricultural Corpn., New York. (U. S. Nos. 1,129,224, 1,129,505, 1,129,509, 1,129,510, 1,129,721; Feb. 23, 1915.)

REDUCTION FURNACE—Plant for the Reduction and Smelting of Ores. Edward D. Kendall, Elizabeth, N. J., assignor of one-half to Louis T. Haggin, Closter, N. J., and Margaret V. Haggin and Allan McCulloh, New York, N. Y., and H. Esk. Moller, Montclair, N. J., executors of James B. Haggin, deceased. (U. S. No. 1,131,709; Mar. 16, 1915.)

SCREENING—Vibratory Screening and Sizing Device. Arthur E. Custer, Salt Lake City, Utah. (U. S. No. 1,131,478; Mar. 9, 1915.)

SEPARATION—Screen for the Separation of Ores. Alfred H. Kidney, Orange, N. J. (U. S. No. 1,131,710; Mar. 16, 1915.)

SEPARATOR—Gravity-Trap Dry Separator. David F. Platner, Monterey, Calif., assignor of one-fourth to Ernest Michaelis and one-fourth to C. N. Tibbits, Monterey, Calif. (U. S. No. 1,131,081; Mar. 9, 1915.)

STEEL—Vacuum Process for Production of Steel. Eugen Dolensky, Frankfort-on-the-Main, Germany. (U. S. No. 1,131,488; Mar. 9, 1915.)

TUYERE CAP. Karl Landgrebe, Ensley, Ala. (U. S. No. 1,129,993; Mar. 2, 1915.)

Editorials

The Situation in Copper

Six months ago the price for copper was about 11c. per lb., unsold stocks were large, the big producers had reduced to a 50% basis and pessimism reigned. Not even the most optimistic in the trade could see anything cheerful in the outlook, and the common idea was that if the war should be prolonged beyond six months nothing but disaster was to be expected. Today we see copper above 15c., stocks of refined copper practically nothing and the big producers on a 75% basis. What was the reason for the error in the forecasts of six months ago?

It was simply that the military requirements for copper were grossly underestimated. The crisis in copper last August was due to the sudden loss of our principal customer—Germany. It was not considered that any probable demand for military purposes would be anywhere near the normal German demand for peaceful purposes. It was indeed foreseen that Germany's exports of copper manufactures would be replaced by exports from other countries to which we should supply the copper as previously we had supplied it to Germany; but even allowing for that it was considered by the big producers to be best to shorten sail and reduce production by about 50%. This was wise, although in looking backward we are able to see how mistaken was the diagnosis of all the doctors. Yet as things were then a maintenance of the production at the July rate or a general curtailment of only 25% might have precipitated the price to a level far lower than that to which it actually fell and might have led to disasters before readjustments could be effected.

About Nov. 1 large buying began and has continued ever since, with but slight interruptions. This has not reflected any noteworthy increase in purely domestic consumption, but has been chiefly for military purposes, cakes, ingots and wirebars being shipped directly abroad, or else to domestic manufacturers and thence abroad in manufactured forms. Not long ago there appeared about contemporaneously a German statement that the copper consumption of the German army was at the rate of about 100,000 metric tons per annum; and a British estimate that the Austro-German consumption must be at the rate of 112,000 long tons per annum. Germany and Austria-Hungary are not obtaining their copper from the outside, but the figures cited are indices that the copper consumption of the Allies is at least as great, and their copper is being supplied chiefly by America. The opinion is held in well informed quarters that all of these estimates are too low rather than too high.

Besides the buying for domestic consumption and for foreign consumption, military and industrial, there has been some speculative buying on marginned transactions anticipatory of the ending of the war and some advance buying for domestic consumption. Altogether the absorption of copper during the last six months has reduced the stocks at the disposal of American refiners to a very small quantity, and it is probable that there has also been a reduction in the stocks of blister copper. While there are no longer statistics about these, the statements of the refiners may be accepted freely, inasmuch as the advancing price and the willingness to increase production are confirmatory of them. Indeed, it is possible that the curtailment of production by 50% was carried on a little too long and that there may be temporarily a shortage of supply while the increased output of the mines is on the road to the refineries and while the refiners' vats are being restocked. Anyway, the situation is so developing that the new production of Inspiration and Chuquicamata, of which we shall begin to hear a good deal about the middle of this year, will be regarded with equanimity. Contributory, also, to the strength of the present situation is the fact that the copper ouput of Mexico is now reduced to a very small figure.

The Position of Amalgamated

The position of Amalgamated, now that it is reduced to a mere holding company, is of considerable interest. On Jan. 1, 1914, the Amalgamated Copper Co. held 3,070,784 shares of Anaconda stock and had outstanding 1,538,879 shares of its own. It, or rather the United Metals Selling Co., also held 42,570 shares of International Smelting & Refining Co. By the exchange of Anaconda stock for International, the Metals Selling Co. must have received 141,900 shares of Anaconda. In the recent sale of assets by the United Metals Selling Co. to Anaconda this stock was excluded, so that Amalgamated should now own about 3,212,684 shares of Anaconda.

On Jan. 1, 1913, the cash and cash assets of Amalgamated were $19,212,885. Its notes payable and current liabilities together were $24,427,524. However, we believe that it is necessary to add $2,308,318 to these liabilities to find the true cash position of Amalgamated, for the February dividend of Amalgamated was to be paid from these assets. Consequently it may be said that there was an excess of $7,522,957 of current liabilities over current assets. This amount should have been decreased in 1914. For each dividend paid by Amalgamated almost exactly the same amount was received from Anaconda dividends—in fact, after the exchange of Anaconda for International stock the amount received would be in excess. Therefore, against the Amalgamated's expenses would be applicable the two dividends received from International, interest on its Butte, Anaconda & Pacific holdings and the profits and commissions from its United Metals Selling operations. Yet, after all, the difference between these debits and credits cannot be great.

Against this what has the Amalgamated after liquidation of the liabilities? It receives about $6,000,000 cash for the United Metals Selling, stock and good will; it disposes of $4,769,900 of its fixed assets (Inspiration, Greene-Cananea, Mountain Trading Co. and other stocks) for cash, and it takes over about $1,600,000 in metals from the United Metals Selling Co. This gives it about $12,370,000 to apply against $7,523,000 of liabilities. So that

Amalgamated should now show an excess of current assets over liabilities of $4,847,000.

Consequently Amalgamated shows assets of 2.09 shares of Anaconda and $3.20 (approximately) per share. Therefore if Anaconda sells at 28¾, Amalgamated should sell at about 63¼.

Amalgamated is now purely a holding company, without that diversity of interests which is usually put forward as the reason for holding companies. As a collector of Anaconda dividends it must of necessity transmit them to Amalgamated shareholders less the payment of Amalgamated salaries and a rather burdensome Federal excise tax. As a market leader, it is thoroughly understood by everyone to be entirely wagged by the Anaconda tail, and it is, as a speculative stock, completely overshadowed by at least half a dozen others.

The American Mining Engineer and His Field

The American mining engineer has enjoyed an enviable reputation both as an examining engineer and as an efficient operating official. He has obtained in some instances eminent recognition outside his country, but as a rule his field has been the United States and Mexico. Must he not enlarge this field?

Long ago the British engineer found himself compelled to look to the world as his field of activity and we think the time is not far distant when the American mining engineer will also be forced to this view. We are not referring to the present surplusage of engineers, due largely to war in Europe and Mexico, but to the not-distant future when the scope of employment for mining engineers in the United States will find itself narrowing. There are still extensive mineral deposits to be developed in this country, but they will be, in the main, of low grade, involving larger operations than in the past, but fewer positions. There is no doubt that the cream has been skimmed off and it may be that the total number of positions open to mining engineers, as such, is declining rather than increasing in this country.

If the American engineer would remain in mining, he must consider the world his oyster, and prepare for its opening. Not only must he prepare himself, but he must educate our capitalists to a realization of the foreign opportunities; and our Government's weak-kneed policy in the protection of its citizens and their interests abroad must be altered. It is a well known and mortifying fact that American mining engineers abroad permit themselves to be mistaken for Englishmen, owing to the superior protection that the British government affords its people. Indeed, it has happened that American engineers have appealed for, and obtained, aid from foreign consuls, after being denied by our Government officials. Let us hope that the time will come when our Government will see to it that American citizens are accorded protection equivalent to that which British and German subjects enjoy in the pursuit of foreign trade.

The American nation up to this time has been busy with the development of its rich country and has not ventured far afield in its investments. There are noteworthy exceptions to this, but in general it is true. At present only a comparatively limited number of our mining engineers direct their attention to the mineral possibilities of Central and South America. Then there are the enormous mineral resources of the Orient. We have in Asia today two striking examples—the Ridder mines in Siberia and the Bawdwin in Burma—where modern metallurgy has unlocked some remarkable deposits that were too refractory for the ancients. To be sure, American engineers are connected with both of the enterprises cited, but these engineers represent a comparatively small group who have recognized the extraordinary mining opportunities in some of the little-developed countries of the world.

The diversity and extent of the mineral resources of this country have afforded an excellent training ground for our engineers. Their efficiency, both as examining engineers and as operating officials, has been proved, but were 100 new mines opened in this country tomorrow, we would still have an excess of engineers. Is not the time at hand when the American engineer must take a major in foreign languages and geography, and follow his British brother into foreign lands?

The Shortage of Ships

One of the serious features of international business at present is the shortage of ships. Of the capacity existing before the war some has been destroyed, some has been interned, and much has been engaged in military operations. This has resulted in an ocean shortage that is calculated by London *Engineering* at 10 million tons.

The effect of this is felt acutely in the trade in metals, so much so that the European and American markets for copper, spelter, lead and tin are completely out of joint. Thus copper, spelter and lead sell in London at prices far above ours, and remain at an extraordinary disparity, for there are no free means for sending our products thither. The export business has become to a large extent a speculation in freights. The trader who has freight room under contract may reap large profits, while the buyer and seller who have been less forehanded can not tell how their transactions are going to result. We have heard of a sale of spelter to France, the seller to ship either in April or May at his option and to one of three ports at his option. Thus the buyer did not know when he was going to get his metal or where he was going to get it.

To make good the deficiency in ocean-carrying capacity sailing vessels have been returned to service and steam freighters are being transferred from the Great Lakes to the Atlantic, such of them as may pass through the Welland Canal, which admits the passage only of vessels of 14-ft. draft. While these additions help, there is no good prospect of an important amelioration of existing conditions so long as the war lasts.

The calcination of calamine used to be practiced generally by the zinc smelters of Kansas; but many years ago was abandoned as useless under their conditions. European producers of calamine have always continued this practice, however, especially for saving freight. It is interesting to report that the operators of the Potosi mine in the Yellow Pine district of Nevada are now calcining their ore, using crude oil for fuel. This ore has to be hauled 22 miles to a railway, and thence nearly 2000 miles to the smelting works, wherefore saving in, carting and railway freight is a very important consideration.

BY THE WAY

The recent murder of John B. McManus in Mexico City has inspired the verse artist of *Financial America* to the following:

A hundred Zapatistas are smashing in my door.
(The Stars and Stripes wave bravely just above it.)
A bomb is lying smoking close by me on the floor.
(This watchful waiting's pleasant—how I love it!)

They've ripped the Grand Old Rag from the place it hung so long—
(That is, since Carranzistas trampled on it.)
I'd like to feel my Colt in the place it should belong.
(But watchful waiting will not let me don it.)

They've set my house afire; they're swiping all my goods.
(I've heard at Vera Cruz our ships are lying.)
I'd give a million pesos to beat it for the woods.
(This watchful waiting's grand—but, Lord, it's trying.)

They've got me in a corner, a bullet's plugged me through.
(I hope my Uncle Sam will hear about it.)
They've kicked me and they've knifed me for cursing all their crew.
(They've fooled you, Woodrow Wilson, don't you doubt it.)

They had murder in their hearts, and now the murder's done.
(I'd hoped that Uncle Sam would show his face up.)
But I'll smile within my grave to hear the greasers run
When Uncle Sam comes down to clean the place up!

⁂

We have several times referred to the main obstacle to tin smelting in the United States being the unwillingness of Bolivian producers to make any long-time contracts here. Nevertheless it does not seem possible that we must always admit our inferiority to German and English smelters, and it is certain that if we can beat them on low tolls, tin concentrates will follow the usual laws of economics. But the more we look at the matter, the more we believe that success will eventually be obtained by a small smelter rather than a large one. The technical results obtained by some of the present junk smelters we have more than once touched upon. Possibly one of these will decide on trying tin smelting, and the following conversation would ensue between owner and foreman: "I want you to smelt down a lot of tin concentrates." "How will I do it?" "Aw, go do it yourself!" And he does it. The large smelter would sent out a committee composed of three directors, a superintendent, two chemists and a stenographer. This committee would visit all available plants and return with the report that it entirely depended on the man in charge, together with a bill for $19,360.17, from which the conclusion would be drawn that the enterprise did not promise a fair return on the capital expenditure necessary for investigation.

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Cananea is still idle and no one ventures even to prophesy when work will be resumed there, the political situation being chaotic. At Nacozari, on the other hand, work goes on, but shipments are frequently interrupted, depending upon which party of combatants intermittently holds the railway. At present one party holds one end of the line and the opposite party the other end, and it does not always suit one party or the other to let trains move. On the whole, affairs at Nacozari have been quite amicable as between the company and the rival factions. The general manager of Phelps, Dodge & Co., in his annual report for the year 1914, says "The production of the Moctezuma Copper Co. has been curtailed by military measures affecting transportation in November and December. But that there may be no misapprehension as to existing conditions regarding our relations with the conflicting political parties in Sonora, it is my pleasure and duty to state that railroad transportation of materials and supplies has been interfered with solely for strategical reasons, and that invariably we have been treated with courtesy and consideration by the officers and troops of both sides." Only once—at the time of the occupation of Vera Cruz—was there advice that the Americans would best withdraw. They retired from the district, leaving the whole of the costly and complicated mining and milling plant in the hands of the Mexican staff, which continued the operation without interruption. During their absence of eight days the returns from the mines and mill were slightly in excess of the average. The Americans had reason to congratulate themselves that their Mexican assistants had shown themselves such apt pupils.

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March Mining Dividends

Dividends paid in March, 1915, by 29 United States mining companies making public reports amount to $1,922,039, as compared with $7,008,732 paid by 27 companies in March, 1914. Industrial and holding companies allied to mining paid $5,317,112 as compared with $12,433,015 in 1914. Canadian and Mexican mining companies paid $630,382 in March, 1915, and $1,950,786 in March, 1914.

United States Mining Companies	Situation	Per Share	Total
Argonaut, g.	Calif.	0.10	20,000
Bingham-New Haven, c.	Utah	0.10	22.869
Brunswick, g.	Calif.	0.06	23,717
Bunker Hill, g.	Calif.	0.02½	5,000
Bunker Hill & Sull., l.s.	Ida.	0.25	81,750
Butte & Superior, z.	Mont.	0.75	203,351
Caledonia, l.s.	Ida.	0.02	52,100
Calumet & Arizona, c.	Ariz.	0.50	308,693
Calumet & Hecla, c.	Mich.	5.00	500,000
Chino, c.	N. M.	0.50	432,410
Duluth & Utah, l.s.	Utah	0.04	2,250
Fed. M. & S., l.s.	Ida.	1.00	119,861
Golden Cycle, g.	Colo.	0.05	75,000
Hecla, l.s.	Ida.	0.01	10,000
Homestake, g.	S. D.	0.65	163,254
Jumbo Ex., g.s.	Nev.	0.05	48,584
Nevada Con., c.	Nev.	0.25	499,864
North Star, g.	Calif.	0.20	50,000
Old Dominion, c.	Ariz.	0.50	81,000
Quincy, c.	Mich.	1.00	100,000
Seven Troughs Coalition, g.s.	Nev.	0.02½	37,500
St. Joseph, l.	Mo.	0.05	70,470
Superior & Pittsburgh, c.	Ariz.	0.20	299,958
Tom Reed, g.	Ariz.	0.06	51,541
Utah Con., c.	Utah	0.50	150,000
Utah, c.	Utah	0.75	1,218,367
Yellow Aster, g.	Calif.	0.02	2,000
Yellow Pine, l.z.s.	Nev.	0.03	30,000
Yukon, g.	Alas.	0.07½	262,500
Iron, Industrial and Holding Companies			
Amer. Sm. & Ref. Co., pfd.	U.S.	1.75	875,000
Amer. Sm. & Ref. Co., com.	Mex.	1.00	500,000
Inland Steel	U. S.	1.00	78,836
International Nickel, com.	U. S., Can.	2.50	948,133
Lackawanna, pfd.	U. S.	1.75	612,115
National Lead, com.	U. S.	0.75	154,915
National Lead, pfd.	U. S.	1.75	426,436
Old Dominion of Me., c.	Ariz.	0.50	146,677
Phelps, Dodge & Co., c.	U. S. Mex	3.50	1,575,000
Canadian, Mexican and Central American Companies			
Esperanza, s.g.	Mex.	0.24	165,848
Hedley, g.	B. C.	0.50	60,000
Hollinger, g.	Ont.	0.20	120,000
Kerr Lake, s.	Ont.	0.25	150,000
Lucky Tiger, g.s.	Mex.	0.10	71,534
Peterson Lake, s.	Ont.	0.01½	63,000

The totals for the first three months of the year are as follows: Mining companies, 1915, $9,520,928, as against $16,271,464 in 1914; metallurgical and holding companies, 1915, $15,896,449, as against $15,828,130 in 1914; Canadian and Mexican mines, 1915, $2,434,364, as against $5,365,157 in 1914.

Fatal Snowslide at Britannia Copper Co.'s Mines

SPECIAL CORRESPONDENCE

Serious loss of life was caused by a slide which occurred at the Britannia Mining & Smelting Co.'s copper mines on Britannia Mountain, near Howe Sound, Vancouver mining division, British Columbia, shortly after midnight of Sunday, Mar. 21.

The group of mineral claims on which the company has opened several mines is situated in mountains of the Coast Range east of Howe Sound, about 20 miles directly north of, and 28 miles by water following the coast line from, Vancouver. Howe Sound is an irregular fiord, cutting well back into the Coast Range, and is bordered along its whole length by rugged mountains and high ridges. The Fairview mine, now being worked, is in the steep mountain ridge which separates Britannia Creek from Furry Creek and is about 4300 ft. in height. The principal workings are in the north slope of the ridge at a distance of three and a quarter miles from the coast and at an elevation of 3275 to 3775 ft. above sea-level.

A great mass of rock, earth and snow slid down from the mountain above the Fairview mine and swept through the camp, and thence down the valley to Britannia Creek, more than a mile away from the mine. Trestles carrying the tracks from the mines, rock-crusher and upper terminal of the aërial tramway, one bunkhouse, cookhouse, stores, offices and officials' cottages and other structures were crushed and either buried deep below a great mass of débris or carried down the valley in the slide. At the time of writing (three days after the slide) 25 bodies have been recovered, among them being those of a woman and her two children. Thirty-three persons are reported missing, including three or four women and several children. Those rescued include two dangerously, eight seriously, and thirteen slightly injured. An official report stated that there were known to have been in the upper camp 163 persons—137 men, 15 women, and 11 school-children. The above-cited figures, therefore, make it appear that the known dead, the reported missing and the recovered injured together number 81, so that 82 persons appear to have escaped. These probably were the men on night-shift underground and other persons living in the eight buildings, among them two bunkhouses, which were not touched by the slide. No such slide has ever been known in the camp before, although work has been going on here for at least 15 years.

The company for years has had its own well equipped hospital at Britannia Beach, with resident doctor and trained nurse always in attendance. Another company doctor lived in the upper camp, where there were several cots, a dispensary, etc. Only a few days before the accident a provincial government official was at the property giving company employees instruction in the use of pulmotors, three of which had been added to the mine equipment.

The Fairview mine is opened by six adits, with from 100 to 250 ft. between levels, with connecting raises from the 1050-ft. level, which is practically at the level of the camp. All ore from above the 1050-ft. level is dropped down the raises to that level, whence it is hauled by a three-ton electric motor to the rock-crusher at the upper terminal of an aërial tramway, the length of which from the upper camp down to the concentrating mill at Britannia Beach is 16,800 ft. This tramway is in two sections. The upper section is 5800 ft. long, with a drop of 1400 ft. to a reloading or transfer station, and thence the distance to the mill is 11,000 ft., with a drop of about 1900 ft.

During the last two or three years improvements have been made with the object of overcoming transportation difficulties attendant upon surface operations at the higher level where the deep snow impedes work in winter. A crosscut adit, known as the 2300-ft. level, starting a short distance from the intermediate station of the aërial tramway, was driven 4336 ft. into the mountain and an 8x12 raise driven to the 1050-ft. level above. A three-compartment shaft, 10x20 ft., starting 3922 ft. in from the portal of the new adit, was sunk to the 1050-ft. level. From the face of this adit a 3-ft.-gage track with 45-lb. rails has been laid to the portal, which is 2100 ft. above sea-level. From there haulage over three and a half miles of side-hill railway will be by electric locomotives. This railway has a maximum grade of 3% and leads to the head of an incline 5500 ft. long, with an average grade of approximately 30%, down to the concentrating mill 1600 ft. below. These late improvements, however, are not yet available for mine use, and the aërial tramway remains the chief means of communication between mines and mill.

SCENE PREVIOUS TO SNOWSLIDE. ALL EQUIPMENT AND BUILDINGS AT ANGLE OF COVERED TRACKS WERE WRECKED

In 1914 the company milled 240,000 tons of ore, from which 12,000,000 lb. of copper were recovered. Crude ore and concentrates amounting to 38,750 tons were shipped to the Tacoma Smeltery.

The Britannia Mining & Smelting Co. is controlled by the Howe Sound Copper Co.

PERSONALS

M. L. Requa is in New York in connection with the Alaska-Juneau flotation.

F. Close has left London for the Caucasus. He expects to return early in May.

H. W. Gepp, general manager of the Amalgamated Zinc Co. of Broken Hill, N. S. W., is visiting New York.

B. B. Thayer is going to Montana on a tour of inspection. He expects to return to New York about the middle of May.

E. P. Mathewson, who has been in hospital in Montreal, has enjoyed a complete recovery and has returned to Anaconda.

Charles Mentzel will leave New York on Apr. 3 for an exploration in the Republic of Panama. He will take with him a party of about 50 men.

Dwight E. Woodbridge, mining engineer, Duluth, Minn., recently returned to that city from a professional trip to the northeastern part of Washington.

H. E. Tuttle, formerly with the Edgar Zinc Co. at Cherryvale, Kan., is to be with the American Zinc, Lead & Smelting Co., at Caney, Kan., after April 1.

T. H. Jenks has returned to Denver from Central City, Colo., where he has completed some examinations, and left last week for New Mexico on professional work.

Joseph W. Boyle, general manager of the Canadian-Klondike Mining Co., was in New York this week, on his way from London to the company's property in the Yukon.

S. H. Brockunier of Nevada City, Calif., who has been in Pittsburgh for several months on business, visited Livingstone, Mont., to examine a mine in that vicinity.

F. H. Sistermans, who has been in Nicaragua for the Mines Management Co., has retired from that company and gone to El Paso, Tex., which will be his headquarters until further notice.

G. G. S. Lindsey, of Toronto, president of the Canadian Mining Institute, who recently returned from Europe has gone on a six-months' visit to China in connection with mining business.

Pope Yeatman will remain in Chile until about the end of May, when it is expected that operations will be going on regularly at Chuquicamata. He is expected back in New York about the end of June.

Leslie H. Webb, secretary of the Wedge Mechanical Furnace Co., was recently at San Francisco where he stopped to see the Panama-Pacific Exposition on his way from Montana to Philadelphia and New York.

Edw. W. Lawler has just completed a trip through the copper district of Michigan and the gold and silver camps of Porcupine and Cobalt, Ont., in the interest of the Jeffrey Manufacturing Co., of Columbus, Ohio.

T. H. Sheldon, who has been connected with the Portland Gold Mining Co., Victor, Colo., for 15 years, has been appointed purchasing agent of the Vindicator-Cresson consolidation, and has offices at 603 Symes Building, Denver.

OBITUARY

G. E. Copeland, of Los Angeles, Calif., was at the Britannia Mine, Howe Sound, British Columbia, at the time of the recent disastrous snowslide, and has since been missing. It is believed that he was lost in the slide.

W. C. Green, well known to the Western mining trade for the past 25 years, and for the past six years representative of the mechanical goods department of the Diamond Rubber Co., died Feb. 13, from an attack of pneumonia. Mr. Green's work will be carried on by C. A. Tracy.

Frank L. Clerc died last month at Denver, Colo. He was born in Pennsylvania in 1861. Graduated from Lehigh University, he engaged in zinc smelting at Bethlehem and became a considerable authority in this art. For the first volume of the "Mineral Resources of the United States" he wrote a monograph on the practice of zinc smelting in the United States which was the best contribution on that subject in its time and is still a valuable work for reference. Also he contributed the article on the metallurgy of zinc to the 10th edition of the "Encyclopedia Brittanica." He was one of the early experimenters upon zinc smelting in the blast furnace. During recent years he was a resident of Colorado and was not actively engaged, but he maintained his interest in his specialty and only last winter was in New York exhibiting a model of a new form of distillation furnace that had been engaging his attention for several years.

Joseph Obalski, president of the Montreal Chambre du Commerce Francaise, and for 28 years director of the Bureau of Mines of the Province of Quebec, died at his residence in Montreal Mar. 25, after a short illness. He was born in France in 1852, his father being a Pole and his mother a French woman, and educated at the High School of Mines in Paris, beginning his career as a mining engineer in 1877, and shortly after going to Canada. In 1881 he was appointed director of the Quebec Bureau of Mines, which position he resigned in 1909. He devoted much time to exploration and was the author of many reports and monographs on mining matters. He was also for some time a professor in the Ecole Polytechnique of Laval University, Quebec, and served a term as vice-president of the Canadian Mining Institute. After resigning as head of the Bureau of Mines, he removed to Montreal, where he practiced as a consulting engineer. Mr. Obalski made many explorations in Northern Quebec, especially around lakes Chibougamou and Obatagamou, and was keenly disappointed when the government abandoned the proposal to extend the coloniztion road from Lake St. John north into the Chibougamou country. He was also much interested in the exploitation of the iron sands of the north shore of the St. Lawrence. He adhered naturally to the French school of geologists in his general work. He was a man of strong character and held decided opinions, which he was always ready to defend; those who opposed him usually found they had a formidable antagonist in discussion. His opinions however, did not affect his friendships, and his death will be regretted widely in Canada.

SOCIETIES

American Institute of Mining Engineers—A meeting of the Southern California Section will be held at the Hotel Clark, Los Angeles, Apr. 8. Algernon Del Mar, of Los Angeles, will read an important paper on the "Mechanics of Crushing."

A meeting of the New York Section will be held Apr. 7, at the Machinery Club, 50 Church St. The meeting will be preceded by a dinner. Following the dinner there will be a discussion of the "Economic Side of Safety and Sanitation" as applied to the mining and metallurgical industry, in which a number of prominent members have already promised to take part.

Institute of Metals—The annual general meeting was held in London Mar. 18 and 19. Routine business was disposed of, but the annual dinner was omitted. The following papers were submitted and discussed: "Some Experiments upon Copper-Aluminum Alloys," by J. H. Andrew; (2) "The Constitution of the Alloys of Copper with Tin. Parts I and II," by J. L. Haughton; (3) "Etching Re-Agents and Their Applications," by O. F. Hudson; (4) "The Effects of Heat and of Work on the Mechanical Properties of Metals," by Professor A. K. Huntington; (5) "The Quantitative Effect of Rapid Cooling upon the Constitution of Binary Alloys. Part III (Conclusion)," by G. H. Gulliver; (6) "The Properties of Some Nickel-Aluminum and Copper-Nickel-Aluminum Alloys," by Professor A. A. Read and R. H. Greaves; (7) "Some Appliances for Metallographic Research," by W. Rosenhain; (8) "The Micro-Chemistry of Corrosion. Part III. The Alloys of Copper and Zinc," by S. Whyte.

TRADE CATALOGS

Frenier & Son, Rutland, Vt., Catalog Frenier Spiral Pump. 12 pp., illus., 3x9 inches.

Automatic Steam Trap & Specialty Co., Detroit, Mich., Catalog 8, 16 pp., illus., 6x3½ inches.

The Lunkenheimer Co., Cincinnati, Ohio. Spanish Catalog Number 51. 128 pp., illus., 9x6 inches.

The Lagonda Mfg. Co., Springfield, Ohio. Booklet. Lagonda Boiler Room Specialties. 14 pp., illus., 6x3½ inches.

A reprint of the National Founders' Association rules for the safe operation of cranes has been prepared by the Whiting Foundry Equipment Co., Harvey, Illinois. This reprint is of size suitable for posting on the wall and will be sent free on request.

Editorial Correspondence

SAN FRANCISCO—Mar. 25

Improved Conditions in North End Comstocks are reported. Consolidated Virginia has a fine prospect on the 2500-ft. level where pay ore was disclosed in the northeast drift. Extension of the drift shows a strong quartz vein 30 to 36 in. wide assaying $1 to $4 per ton. This is in hitherto unexplored territory and is considered especially important on this account. Union Consolidated work is being carried forward both north and south on the vein from the west crosscut on the 2650-ft. level, showing streaks of good ore. Mexican is stoping on and under the 2300-ft. level. Satisfactory progress is reported in the new 2700-ft. drainage work and the recovery of the level is expected soon. The pumping association reports progress. Heavy winches for handling the centrifugal pumps in the Con. Virginia winze have been removed to the joint Mexican and Ophir winze and placed on heavy concrete foundations. Compressed air hoist for handling men and materials also placed in the winze.

Brunswick Consolidated Gold Mining Co. operations at Grass Valley, Nevada County, for the last year were interesting not so much for the increased yield and constant payment of large dividends as for the methods of mining and the per ton cost of production. The mine produced 16,237 tons of ore at a cost of $10.221 per ton, yielding $17.76 per ton. The cost of production per ton of ore mined and treated was equal to the gross value per ton of ore produced in a great many mines of the state. In fact $10 ore in most of the mines of the Mother Lode region would be considered bonanza ore, and if the cost of mining and treatment exceeded $3 per ton it would be considered excessive. Even $17 ore in the ordinary course of mining would not be expected to stand a cost of $10 per ton. But the making of a mine has been the policy strictly adhered to and the results amply justify the practice. The report of the general manager states that the per ton cost of production could have been reduced to $7.50 if the management had been content to suspend operations at the new shaft and reduce the dead work to a minimum, and keep the mill going with ore from the stopes above the 1250-ft. incline level. The new vertical shaft was deepened 240 ft. at a cost of $91.94 per ft. The total depth of the new shaft is 1100 ft. The company expended in the year about $45,000 for development and improvements, and the contemplated development and new metallurgical equipment in 1915 will probably exceed this sum.

SALT LAKE CITY—Mar. 26

The Zinc Ores of the Tintic properties as well as mines in other parts of the state are being given considerable attention. Among the properties shipping this class of material are the Colorado, Iron Blossom, May Day, Uncle Sam, Yankee, Sioux Consolidated, Beck Tunnel, Godiva, Gemini, Ridge Valley and Chief Consolidated in Tintic. The present output of this camp is between 1350 and 1500 tons of zinc ore a month. The average grade is about 28 or 29% zinc; the lowest grade that can be marketed carries 24 or 25% zinc, and the higher grades 35 up to 40%. The ore is largely oxidized, consisting principally of the carbonate, smithsonite. Most of the shipments are made to Iowa and Altoona, Kansas. The Bullion Coalition and D. W. Lynch at Stockton, and the Ophir Hill Consolidated at Ophir are shipping zinc ores. The Cedar-Talisman, Hornsilver and other properties in Beaver County are also shipping. Some of the Beaver County zinc shipments go to Bartlesville, Oklahoma.

The Growth of the Mining Industry in the intermountain states during the last five years is shown by data compiled by the National Copper Bank of Salt Lake City. The production of silver, copper, lead, zinc and gold from 1910 to 1914 in Utah, Idaho, and Nevada is given, together with the value of this production for the period. The value of the metal output of Utah in 1910 was $31,655,049; for 1911, $34,325,503; for 1912, $42,922,302; for 1913, $44,858,210; for 1914, $38,000,000. In addition to the above, a table showing the production of other minerals including coal, asphalt, cement, stone, clay products, hydrocarbons and rare metals is given. The value of this output in Utah ranged from $7,578,657 in 1910 to $8,748,310 in 1913, the latest figures obtainable. From a table giving the production from the rest of the country, including Alaska, during the same period it is shown that Utah mines have more than held their own, having gained 12.8% during the period 1910-1914, whereas the rest of the country increased only 10.8%. Taking the three leading metals, silver, copper and lead, there has been a gain of 30.8%, as compared to a gain of 8.4% for the rest of the country. The gold production, always the smallest but one, was the only one that has steadily fallen, and this is explained by the decrease in the output of Mercur, Utah, and the decrease in shipments of outside ores principally from Goldfield, Nevada. This is much more than offset by the increased production of other metals. The production of silver, lead and zinc has advanced steadily each year beyond the preceding one. The growth of the industry is such that what is called a poor showing in 1914 exceeds the high output of 1910 and 1911. Attention is called to the stabilizing and energizing effect on every local industry by the constant inflow of cash from the sale of Utah's mine and smelter products.

The Muddle in the University of Utah Affairs continues. A suit to forfeit the charter of the university has been prepared by members of the alumni association, alleging that the enabling act reserving Federal land for the institution has been violated, by reason of the University having become a sectarian institution. Col. E. A. Wall has withdrawn the Wall scholarship maintained by him in the metallurgical department. Various meetings of alumni, and Salt Lake clubs, including the Federation of Women's Clubs, have been held to discuss this situation and to urge a public investigation of university conditions. A meeting of 350 students was held to ascertain the number who intended to return next year. Almost everyone signified his intention to have returned had no trouble in the faculty arisen, but only 34 announced their intention to return next year, in the event that the professors who have submitted their resignations are not retained. The president of the University asserts that there will be no trouble in filling the vacancies on the faculty, but those of Salt Lake citizens who have the interest of the University at heart are not so sanguine about this. The Federation of Women's Clubs has wired to all state universities in the country asking them not to employ any of the resigned professors until they have received a full statement of conditions and they have passed resolutions demanding the reinstatement of the resigned members. Charges of political and church influence are rife. Of the 13 regents of the University, nine are members of the Mormon Church. Three out of the four members of the executive committee are also members of the Mormon Church. The four members of the faculty dismissed, and the ones demoted are all Gentiles. The man elected to succeed to the head of the department of English is a Mormon bishop, who is said to have had no experience in university work. It is alleged that the professors were forbidden to discuss either religion or politics in their class work. The president of the University combats the accusation that the institution is dominated by the Mormon Church, by quoting figures to show that 75% of the population of the state is Mormon, and that the percentage of Mormons on the faculty is, therefore, not out of proportion. Former U. S. Senator Joseph L. Rawlins is said to have been active in the matter of the proposed suit against the University to have the Federal Government take away the grant giving land to the university. This suit, it is feared, will bring many complications because all land grants given to the State were included in the enabling act which gave the land allotment to the University. A prominent member of the Alumni Association suggests that the president be made president emeritus, for two years, which would enable him at the end of that time to retire on the Carnegie pension fund, which action, he believes, would remove the stumbling block and enable a satisfactory solution of the problem.

SEATTLE—Mar. 22

That the New Tolovana District gives greater promise of becoming a scraping or dredging than a drift-mining camp is the opinion of many Fairbanks mining men. Pay running from 60c. to $3 per sq. ft. has been reported from several claims, but nothing definite will be known until water runs and sluicing commences in the spring. The most recent report of pay is from the mouth of Gertrude Creek, which enters Livengood at 4 above Discovery. The depth to bedrock is 50 ft. and the pay goes $1 per sq.ft. Below Discovery

nothing of importance has been found. Prospects are also reported from various other creeks, including Cacy, Wilbur, Ruth, and Mike Hess. Over 200 claims have been recorded from the district to date and many others have been staked. The general belief at Fairbanks is that, although nothing of startling richness has yet been discovered, there is still an excellent chance that a permanent camp will be developed.

The Second Territorial Legislature of Alaska, now in session at Juneau, will probably make short work of the so-called Roden mining law, which was passed two years ago to supplement the Federal law. Two bills have been introduced looking to the repeal of the law, known as the Act of Apr. 30, 1913, either of which will leave the situation exactly as it was before the first legislature met. The Roden law had some good points but was generally unpopular throughout the Territory, and in view of the failure of the first attempt to improve on the Federal law it is likely that the present legislature will repeal the old act and go slowly in the making of new supplementary regulations. Another bill of interest to miners is one introduced by Senator Aldrich of Nome to provide for the care of aged and penniless prospectors. These are now sent to the Pioneers' Home in the abandoned army barracks at Sitka, where the cost to the Territory for each inmate is $29 a month. The Aldrich bill provides for a cash allowance, or pension, and permits the prospector to reside in his home district, where he can contribute to his own support by trapping, hunting, etc. In this way it is hoped to remove the stigma of pauperism and at the same time to decrease the cost to the Territory.

WALLACE—Mar. 25

Zinc Mining in the Coeur d'Alenes has come to be an important factor in the life of this district, and it is possible that it may supplant lead in the position of first importance. A few years ago zinc was a positive detriment to the district, but owing to its new importance on account of the effect of the war on foreign production, it is no longer the subject of anathema for the miner. The state mine inspector is authority for the statement that the third largest zinc mine in the country is in Idaho, the Interstate Callahan which by the way is doing considerable new construction and expansion. The Frisco mine abandoned years ago because of the increased zinc content in its lead ore has been reopened for its zinc. Thus times change.

GOLDFIELD—Mar. 26

No New Development in the apex litigation between the Booth and the Jumbo Extension has occurred this week. Both companies are cleaning out the old workings in their mines to facilitate the work of the experts in their investigations, and the Booth is sinking a new inclined shaft for the sole purpose of establishing clearly its claims to extralateral rights on this vein. During the week, a meeting of the directors of the Merger was held, and the question of the validity of the sale of the Velvet claim to the Jumbo Extension by the Merger was raised by the minority directors, Ericson and Smith. Practically all of their motions relative to investigations and criticisms of this sale were voted down by the other three directors and the two minority directors left the meeting. Subsequently the majority of the board passed a resolution declaring the sale by the company was valid, and expressing willingness to have the validity of the sale investigated or tested, apparently accepting responsibility therefor. Mr. Smith was served with notice the day before the meeting of a suit brought by a Goldfield bank to recover upon his promisory note for $16,610, dated Apr. 29, 1914. The note was for six months, and no part of it has been paid. Just why action was not brought before is not stated, and whether it has any connection with the differences in the board of directors is also not stated but Smith's holdings in the Merger have been attached in connection with this note suit. The management of the Lone Star Consolidated has suspended operations in shaft No. 2 on the extreme southwestern section of their property on account of the uncertainty which has arisen through the apex litigation which is now disturbing the camp. All of this muss and the pending and threatened litigation over apex of various veins here and in Tonopah argue very strongly for the repeal of the present apex law and the establishment of vertical boundary lines which would eliminate all of this costly, unproductive, and uneconomic litigation.

LORDSBURG, N. M.—Mar. 27

The Local Mining District is holding its place as the second largest producing area of copper in the State and according to present plans the output will be largely increased. The obstacle of ore-transportation from the mines to the railroad, a distance of over three miles, is being removed. A caterpillar tractor with hauling capacity of 60 tons, will be put to work next week; the operators have sub-leased all ore freighting contracts. Men from Clifton, Ariz., are promoting the project. The Arizona & New Mexico R.R. has also filed intention to build a spur from its lines to the mines, protecting its right-of-way with the state corporation commission. During February 143 carloads of ore were shipped to El Paso and Douglas smelteries from Lordsburg. The 85 Mining Co. has finished its new power house and has ordered a double-drum electric hoist to be installed in the main tunnel level, replacing the gasoline hoist. It has also contracted for air drills and is making preparations for a larger output. The Bonnie Mining Co. has finished its new power house and is now operating two shafts. During development in the No. 2 shaft a blind ledge showing better ore than any other place on the property, was encountered. The intentions are to sink 500 ft. and connect with the No. 1 shaft, farther down the hill. In general, the producing mines of the camp are in an excellent condition. The Lees' Peak mines are being developed and are making encouraging progress.

The Discharge of Tailings from the mills of the Socorro Mining & Milling Co., the Ernestine Mining & Milling Co., and the Deadwood Mining & Milling Co., of Mogollon, Socorro County, into the 'Frisco River must stop or the state will take action toward abating the nuisance. Complaints have been made by the farmers of Greenlee and Graham counties in Arizona that the tailings discharged by the Mogollon companies are carried through irrigation canals and deposited upon the land of private owners and that the sediment thus deposited is injurious to both the lands and the crops growing thereon. The state also complains of the nuisance on the account of state land being under cultivation and irrigated by waters from the streams carrying the Mogollon mill tailings. The Attorney General of Arizona who made the notification states that the Socorro Mining & Milling Co. is making an effort to abate the nuisance but that the other companies have made no effort to end the trouble and that unless something is done at once he will take legal action. In his letter to the companies he refers to the case of the State of Georgia vs. the Tennessee Copper Co. and the Arizona Copper Co. vs. Gillespie. In the first case the United States Supreme Court enjoined the Tennessee Copper Co. and the Ducktown company from discharging noxious vapors into the atmosphere to the detriment of the crops in Georgia, across the line. In the same court the Arizona Copper Co. was enjoined from discharging its tailings into the San Francisco River which supplied the irrigation waters for the settlers holding lands in the Gila valley.

HOUGHTON—Mar. 31

In the Kearsarge Lode the most important physical development since its commercial exploitation by the Wolverine was the footwall development inaugurated in the South Kearsarge shafts three years ago. Formerly the foot wall was considered the outside limit of commercially possible rock. In 1913 two-thirds of the tonnage was mined from the footwall and during 1914 the same proportion was secured from the footwall. The rock is averaging close to 18 lb. per ton. The tonnage from the shafts, 1 and 2, will run close to 40,000 during March. Not only is this rock showing the highest copper contents of any mined by this company, but it is the cheapest mined. Notwithstanding the impression that the South Kearsarge is about ready for abandonment, the fact is that active mining operations from practically all openings continue in both shafts and while the drifts have been extended to the property limits in most instances, the lower levels have by no means been worked out.

Every Producing Mine in the Copper District is turning out all of the copper it is possible to produce without increasing its working forces. The total output of copper for April will be larger than for March although the figures for March will show large increases. Lake Superior mines are profiting substantially from the European war. Whether the demand for copper will continue at the close of the war or whether the market will fall to pieces is concerning the mine managers deeply. There are numerous instances of the spread between the prices secured for Lake Superior's best brands of metal and its poorest brands. And the spread between Lake brand and electrolytic brand is greater than it has been in years, to the advantage of Lake. The spread has been so noticeable that some of the inferior brands have been re-smelted in order to bring them up to the qualifications required for the government contracts. The fact that there is such a premium for Calumet & Hecla and other high grade Lake Superior brands and that the market is pretty well cleaned of these brands at a season of the year when the docks usually are loaded with copper, indicates conclusively that this is due to the continuance of the war and the manufacture of war munitions by concerns in the United States.

Annual Report of Isle Royale shows that there is but one solution of the problem of making this property over into a

paying mine—that is a great increase in production. Two years ago plans looking toward that consummation were made. With copper at 13c. it is just possible for Isle Royale to get a new dollar for an old dollar. The margin is close. Last year there was practically no profit; the cost of copper was 13.05 and the copper brought 13.16c. per lb. Isle Royale, like Quincy, is a very low grade proposition, and requires the closest economy to make it pay. And it cannot be operated on a small scale under any circumstances without a loss. On a daily rock tonnage of 2000 tons Isle Royale must sell its copper at 14c. to make a profit. An average of 14c. for the output cannot be figured on. If the rock tonnage can be maintained at 3000 or better Isle Royale can make a profit on a 13c. metal and pay dividends on 14c. And that is what may be expected in the latter half of 1915 if present plans mature. The rebuilt stamp mill will be able to care for about 2000 tons daily, which is a large demand for continuous performance for a three-stamp mill. And two heads in the Point Mills plant will be ready for use for this company at that time. The openings in the mine are extensive enough to enable a production of 3000 tons per day. The present year ought to see Isle Royale get into her stride and 1916 ought to see her come into her own again.

The Question of Wages is one that will have to be met very soon. There is no doubt at all that every mine would increase wages if there was any reasonable surety that the metal prices would remain where they are. A wage-scale increase does not, in reality, influence the pocket books of such a large number of men as is generally supposed. At the Calumet & Hecla and all its different mines and subsidiaries, both the trammers and miners are on contract systems. This contract system has been the vogue at the Calumet & Hecla for many years and has worked out satisfactorily to the men and to the company. When the Calumet & Hecla interests took over the Bigelow mines they put the contract system more generally in force in those mines. The men get larger pay checks and the company gets a larger tonnage of rock. With this system operating on at least 10,000 underground employees it is creditable to the management that there is so little friction and such general appreciation of its advantages. When the European war broke out and different plans were put into effect at different mines the Calumet & Hecla reduced wages 10%, putting the pay back to the rate in effect when copper is under 15c. per pound and the mines worked three-quarters time. Officers and salaried men were cut 15 per cent. The result was that every underground man speeded up and the contract miners were able to make their monthly income show pretty close to regular figure, even on part time. Since then the salaried men have had their pay restored and the presumption is that the 10% raise will be made to the miners just as soon as the stability of the metal situation seems assured and some substantial sales are made at the higher prices for delivery within 30 or 60 days. Outside of the Calumet & Hecla and subsidiaries there have been some instances of increases in pay, bringing the scale up to that which now is paid at the Calumet & Hecla, but there are others which continue to operate at a scale lower than that. So far as the employees are concerned there is no talk of any further labor trouble. The Finns have established themselves solidly against the red socialists, and the Croations likewise have held meetings and have gone on record as opposed to the United Mine Workers or any other labor organization. The mining companies have not added to their working forces to any extent as yet and there is plenty of labor to be had. Practically all of the agitators have left the district, finding it rather unhealthy.

DULUTH—Mar. 27

A Bill to Limit the Per Capita Expenditures of any village or city in the State of Minnesota to $25 has been introduced in the state legislature by the mining companies owning properties on the Mesabi range, who have risen in arms against the extravagant expenditures of money by villages on the range. The bill has been reported on favorably by the committee to which it was referred and will undoubtedly become a law. In the majority of villages on the Mesabi the mining companies pay about 95% of the taxes and they have been objecting strenuously to the way money has been squandered. They presented many pages of evidence before the committee, and the legislators from districts where the per capita tax is only $5 and $10 were amazed at the startling figures from the Mesabi. It was shown that the village of Buhl spent $125 per capita in 1914; Keewatin, $374.10; Mountain Iron, $120.21; Hibbing, $85.36. The figures for the other towns was just as startling. The village of Hibbing had 1318 votes at the last election, but there has been an average of 852 persons on the village pay roll during the last 14 months. Hibbing has 668 metal ornamental lighting poles, more than the city of Cincinnati, installed at a cost of $81,833. Hibbing employed 40 policemen during 1914, while Duluth, with 10 times the population, had only 80. Hibbing levied a village tax in 1914 of $750,000 and spent $1,169,733, and had on Feb. 1, 1915, outstanding warrants amounting to $1,252,596. Hibbing has a population of about 11,000 inhabitants. The village of Chisholm, with only a few thousand inhabitants, levied for village purposes only in 1914, not including school taxes, the sum of $319,483, and in eight months of that year spent $475,280. On Mar. 1, 1915, the town had outstanding warrants amounting to $495,131. Public improvements in Chisholm since 1908 have cost $1,002,086. The village of Buhl cast 172 votes at the last election, and has had 113 persons on the pay roll during the past 13 months. Keewatin cast 143 votes in the spring election of last year, and had 161 men on the village pay roll in July. Hibbing has paved virtually every street to the village limits and nearly all of the alleys. The township of Stuntz spent in 1914 more than $900 for every voter. During the past winter Chisholm established a conservatory in her palatial high school and grew tomatoes that ripened at a cost of $30 each. When Chisholm wanted a ball team she put her hired ball players on the municipal pay roll. The village of Buhl uniformed its village band out of the village treasury and sent it through Minnesota in a private car. The new Chisholm high school, which was erected at a cost of $268,000, will this year graduate a record class of 10 or 11 pupils. It is said that Hibbing employs a bright young man who devotes his time to thinking up new jobs for the faithful. If the city of Minneapolis had as many city employees in proportion as Hibbing, her pay roll would carry fully 30,000 men. It is not surprising that the mining companies should object to the way that money has been squandered, when it is remembered that the mines have to stand most of the taxes. The per capita tax in towns on the Michigan ranges is only about $8 to $10 and the towns there are just as well off as in Minnesota where money has been thrown away. The towns in Michigan have fine streets, good lighting, water and sewer systems and everything else that is necessary, but they have received full value for the money which they have to get these improvements. The same is true in the sections outside of the mining regions in Minnesota, and the legislators from there were surprised at the way matters have been handled on the Mesabi range.

GALENA, KAN.—Mar. 20

The Old Cyclone Mine, situated on the Land and Cooley land northeast of Galena, is again being put into operation. It once was one of the richest mines in the district, but the former operators had a cave-in and operation ceased. The mine has been idle for 25 years. J. Franklin Smith, of Joplin, Mo., has purchased a quarter interest in the mine and believes it will only be a matter of a few weeks until an excellent mill proposition will be developed, as a good run of ore has already been encountered.

CHIHUAHUA, MEX.—Mar. 23

The Viewpoint of an American, a long time resident in a peaceful section of Mexico, would be different than that of one viewing the situation with the perspective of greater distance; nevertheless, the following correspondence is of value and, seeming to bear out his optimism, is the fact that the letter of date arrived on practically schedule time:

Mining Operations in Northern Mexico have been greatly hampered during the past few months by a shortage of labor and freight handling facilities. In many of the smaller camps, away from the railroads, it has been impossible to get labor, while even in the larger camps some of the mines have had not more than half the men needed. In the state of Chihuahua, mines having railroad connections have been reasonably well served in the way of transportation, but where mule or wagon freighting has to be depended upon it is very difficult to get supplies to the mines or ore to the markets. How long the present conditions are going to continue is impossible to foretell, but the belief seems to be general that, if the party now in control of all northern Mexico is as successful during the next few weeks as can reasonably be expected, conditions will soon become better. Even now, confidence seems to be reviving, and a number of American companies have sent their engineers into the state of Chihuahua in search of favorable investments, and a number of properties have been bonded and some have been purchased outright. At Santa Eulalia, Parral and Santa Barbara the mines are operating about as usual. The mines and mills at Batopilas are producing about 30,000 oz. of silver monthly. The Chihuahua plant of the American Smelting & Refining Co. is operating a sufficient number of furnaces to handle the ore of the district, and will blow in other furnaces as needed. It is reported that the government has taken over the smelting plant at Santa Rosalia and is operating it on local ores. The smelting works at Torreon has resumed operations and at least one mine in this district has made shipments of ore to it.

The Mining News

ALASKA

THE CHICAGOF MILL will be increased to 25 stamps. About 108 men are employed at mine and mill and 40 more on Monroe & Barker timber contract.

ENTERPRISE (Limestone)—This company doing development work on holdings at Limestone, plans installation of five-stamp mill. W. A. Irwin is superintendent.

SHROPSHIRE, ZUBER & CAMERON (Ruby)—Operators found pay on Little Pup, tributary of Poorman, and are driving tunnels and laying in supply of wood for summer.

CONSOLIDATED MINES (Fairbanks)—This San Francisco company will send engineer to examine 2000 acres of ground in Tatlanika placer district. Tract is known as Timmons property and lies near cañon; suitable for dredging, hydraulicking, or scraping.

VAN CURLER (Fairbanks)—Van Curler spent most of winter prospecting ground on middle fork of Big Chena River, but had much trouble with water in shafts. On Palmer Creek, Fred Struthers and partners have prospected ground thoroughly and constructed bunkhouse, messhouse and boilerhouse in preparation for busy season.

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—Directors have voted to resume operations at mine.

Gila County

OLD DOMINION (Globe)—Conditions improving slowly in mine water situation. Pumps gaining on water below 1400-ft. level. Rainy season apparently over; no further difficulty expected.

Maricopa County

RUSSIAN (Phoenix)—Carl M. Hooper will install a new hoist and other equipment on group of claims in Congress district.

Yavapai County

GRAY EAGLE REDUCTION (Mayer)—Reported will build plant near here for treating ore by means of electric reduction.

FORTUNE (Prescott)—Two 50-hp. gas engines freighted from Prescott to 10-stamp mill on Big Bug Creek. When they are installed stamps will begin dropping.

CALIFORNIA

Butte County

STAMP MILL INSTALLATION contemplated by L. E. Osborn at his mining property at Deer Lake.

BELL (Forbestown)—New five-stamp mill nearing completion. Lower tunnel encountered oreshoot 1000 ft. in from the portal. Raise at this point will be driven for ventilation.

Eldorado County

IVANHOE (Garden Valley)—Stamp mill removed from Georgia Slide mine to this mine where quantity of good ore is ready for crushing.

RISING HOPE (Placerville)—Development of this drift gravel mine reported to warrant installation of crushing mill built by the Placerville foundry. Air shaft from lower drift to surface is completed.

OTTER CREEK (Georgetown)—J. B. Kelliher is operating one of largest shooters in this region. Is installed on creek at intersection of Quartz cañon and Deadman's gulch, and sets on bedrock extending 30 ft. along stream. Is 16 ft. wide at bottom and 96½ ft. wide at top. Height from bedrock to bottom of bulkhead 25 ft. 4 in. Gate 30 ft. wide, 6 ft. high and hinged every 6 ft. With several hundred feet of backing it discharges approximately 23,000 in. of water for five minutes.

Santa Clara County

QUICKSILVER MINING (New Almaden)—Proposed new reorganization under Virginia laws to own total stock of New Almaden company owner of 25-year lease on quicksilver mines. To receive 20% royalty from latter company. Company operated at loss for several years.

Shasta County

MOUNTAIN COPPER (Keswick)—New concentrator has started operation. At mine 265 men employed, largest force in five years.

COLORADO

Lake County

EMPIRE GOLD DREDGING (Leadville)—Has leased from Derry Mining & Land Co. 1500 acres of Derry ranch, about 10 miles from Leadville, in the Arkansas River Valley. Proved area containing coarse gravel consists of 125 acres approximately 35 ft. deep, disclosed about 20c. per cu.yd. The New York Engineering Co. will furnish 6-cu.ft. electric-driven dredge, wood hull, all-manganese-steel buckets.

IDAHO

Shoshone County

HYPOTHEEK (Kingston)—Plans for long aërial tramway and new mill completed. Funds provided by recent bond issue.

MICHIGAN

Copper

NEW ARCADIAN (Houghton)—At 900 ft. showing of vein matter is better than at any point in development of this property, particularly to the north, where drift is in 150 ft. At this point character of rock is similar to that shown at 250 ft. Vein has widened out to 12 ft. and commercial rock shows a good portion of that distance.

QUINCY (Hancock)—Production continues at maximum capacity for three shafts. Have been no difficulties with airblasts for five months. Liberal use of rib-work for back filling in lower levels proving an effectual barrier. First series of air blasts were nine years ago. Rock packs used in small way and stood test for three years. In 1914 air-blast troubles brought about thorough eramination of general conditions. Management satisfied that rib-work system is best means of limiting damage done.

Iron

MUNRO (Iron River)—Now working full crews at all its mines in Iron River field. Operations resumed two months ago after a shut-down of five months.

INDIANA (Iron Mountain)—This is first mine on Menominee range to ship ore this spring. About 125 cars being sent out daily to Thomas Furnace Co., Milwaukee. Mine was opened only a few months ago. Flow of water has increased to 700 gal. per minute.

BALKAN (Alpha)—Winston Bros. are assembling their forces and will start stripping within a few days. Part of overburden was removed last summer with drag-line buckets and by fall most of dirt will have been removed. No ore will be shipped this year.

BRISTOL MINING CO. (Crystal Falls)—Several drills are still being operated between Crystal Falls and Fortune Lake. Results of work are not being given out. Churn drills are being employed to test ledge. Deeper holes will be put down with diamond drills after preliminary drilling is completed. Territory has always been considered promising for iron ore.

CRYSTAL FALLS (Crystal Falls)—Detroit parties have secured an option on this mine, which has been idle for sometime, and will start development work. Old north workings will be thoroughly explored. It is believed that orebodies of Hilltop and Victoria mines form a junction at north end of Crystal Falls property. Shaft may also be put down deeper to reach a small orebody known to exist below bottom level.

MONTANA

Silver Bow County

BUTTE DULUTH (Butte)—Property closed down. Doors and windows boarded up. Throws 110 men out of work. No explanations made by receiver or management.

TUOLUMNE (Butte)—Plans made for early resumption of deepening of shaft to 2800-ft. level which will be 100 ft. below adjoining North Butte 2800-ft. level. Both mines lost Jessie and Edith May veins at 2200 ft., North Butte finding better ore on 2800-ft. level.

NEVADA

Douglas County

RUBY HILL (Gardnerville)—Property in Pine Nut range, 14 miles west of Gardnerville, bonded and work started. Incline shaft, 140 ft. deep, equipped with gasoline hoist and pump. Some lateral development on two levels and in two tunnels. Small tonnage good copper ore opened. Considerable churn-drill prospecting done in surrounding territory.

Esmeralda County

SIMMERONE (Goldfield) — Shaft will be sunk 200 ft. deeper.

GREAT BEND (Goldfield)—Small mill will be enlarged, making possible treatment of all ore, and eliminating costly wagon haul. Regular shipments from 150-ft. level being made.

ATLANTA (Goldfield)—Recent strike 1750-ft. level raise making good. Twelve feet of 30-ft. vein averages $30 and remainder $10 per ton. Have shipped five carloads ore from this strike this month.

GOLDFIELD CON. (Goldfield)—Annual report 1914 shows 338,192 tons ore produced; 332,750 tons averaging $12.57 milled and 5442 tons averaging $29.01 were shipped. Total net operating costs $5.91 per ton. Net profit $1,036,533 against $1,486,013 last year.

Humboldt County

PLACER GOLD AT BUFFALO PEAK, 30 miles from Lovelock, discovered. Gold pannings made for distance of one mile along gulch. Scarcity of wood and water will make prospecting difficult.

ROCHESTER MINES CO. (Rochester)—New 10-stamp mill, expected capacity 100 tons daily, began operations Mar. 13; first mill in this camp. Stated 100,000 tons milling-grade ore on dumps of Rochester. Extension of railroad from mill to mines at head of Rochester cañon will be started soon.

Lincoln County

PIOCHE ORE SHIPMENTS for week ended Mar. 25 amounted to 80 cars estimated 4000 tons valued at $40,000, compared with 84 cars for each of the two weeks previous. Shippers were Prince Consolidated, 73 cars; Amalgamated-Pioche, 6 cars zinc ore; and Big Four Exploration, 1 car.

Lyon County

NEVADA-DOUGLAS (Ludwig)—Stockholders meeting held recently and voted to reorganize. New company, to be known as Nevada-Douglas Consolidated Copper Co., incorporated under laws of Utah for 1,000,000 shares, $5 par value. Nevada-Douglas share holders receive share for share in new company. Moore Mining Co., included in consolidation, will receive 10,000 shares. Indebtedness of both companies assumed by consolidated company.

Mineral County

ESMERALDA COPPER CO. (Luning)—Compressor will be installed and more extensive work done.

LUCKY BOY (Hawthorne)—Tunnel now under Hubbard shaft. Crosscuts will be driven and raises lifted to old workings above. Small seams silver ore opened.

GIROUX (Luning)—Operations resumed on this group 14 miles north of Luning. New compressor will be installed and shaft sunk to water level, 600 or 700 ft.

Nye County

TONOPAH ORE PRODUCTION for week ended Mar. 20 was 10,940 tons estimated gross milling value $222,880. Producers were: Tonopah Belmont, 3910; Tonopah Mining, 2950; Tonopah Extension 1730; West End, 998; Jim Butler, 1150; Tonopah Merger, 150 and Montana-Tonopah, 52 tons.

HALIFAX (Tonopah)—Three machines started development work recently on 1050-, 1161- and 1200-ft. levels.

NORTH STAR (Tonopah)—Winze from 1050-ft. level cut 2½-ft. oreshoot of good grade at depth of 35 ft. Raise now being lifted from level below to connect.

TONOPAH BONANZA (Tonopah)—Power line 4000 ft. long from Nevada-California company's main transmission line being built to provide power for pumps and compressors. Steam will be used for hoisting until depth of 900 ft. is reached.

NEW JERSEY

Sussex County

NEW JERSEY ZINC (Franklin Furnace)—Company is building a first-aid house, 30x60 ft., to be fitted up with latest apparatus for use in case of accidents. Dr. F. P. Wilbur of Franklin Hospital will give lectures and demonstrations to employees on first-aid work.

SOUTH DAKOTA

Lawrence County

MOGUL (Terry)—Capacity of mill has been gradually increased to 120 tons daily, best previous month's run averaged 100 tons daily. An additional agitator will be installed.

NEW RELIANCE (Trojan)—During past fiscal year stamp mill treated 23,088 tons ore, average 63.1 tons per day. Bullion recovery $3.12 per ton, or 91.8%. Sand is leached; slime treated by continuous decantation, followed by dewatering and washing on Portland revolving-drum filter.

GOLDEN REWARD (Deadwood)—During past few months considerable work of remodeling has been done at cyanide plant. New equipment includes Dorr and Trent apparatus in steel tanks, circular steel ore bins, tube mill and crusher. Continuous decantation will be tried. No changes made in sand treatment. Plant operating at 150 to 200 tons daily capacity.

UTAH

Beaver County

MOSCOW (Milford)—Lead-silver ore has been opened in another place in the Back vein, by a winze from the 100-ft. level.

CEDAR EXTENSION (Milford)—Stock of this company recently listed on local exchange. Last shipments made in 1906. Joseph Geoghegan is president.

CEDAR-TALISMAN (Milford)—Several cars of zinc ore have been shipped recently. Underlying the zinc, in the mine 2½ ft. of silver-lead ore has been found, and under the lead is zinc, again.

LEONORA MINING & MILLING (Milford)—Silver-lead ore has been opened for 195 ft. on the strike at this property in Star district. There is some zinc along border of the lead.

HORN SILVER (Frisco)—The recent strike of lead-silver ore in the Clayton lease on the 150-ft. level has been opened 100 ft. on the strike and five sets in width. This ore is about 125 ft. from King David line. Horn Silver has taken a year's lease on part of neighboring ground.

Juab County

TINTIC ORE SHIPMENTS for week ended Mar. 19 totaled 96 cars, estimated at 4800 tons, valued at $120,000, compared to 74 cars previous week. Shippers were: Centennial-Eureka, 20; Iron Blossom, 18; Eagle & Blue Bell, 9; Chief Consolidated, 8; May Day, 8; Gemini, 7; Lower Mammoth, 5; Dragon Consolidated, 4; Beck Tunnel, 3; Sioux Consolidated, 3; Victoria, 3; dumps, 3; Gold Chain, 2; Colorado, 2; Uncle Sam, 1 car.

TINTIC STANDARD (Eureka)—Silver-lead ore is being mined on 1200-ft. level. Another 200 ft. of sinking may be done. E. J. Raddatz is manager.

MAMMOTH (Mammoth)—After having been tied up for the winter, water line owned by this company supplying the town of Mammoth was placed in commission the week ended Mar. 13. Work at the mine has been resumed with 20 men. Development is being done on the 600-ft. level.

Salt Lake County

CARDIFF (Salt Lake)—Shipments being made irregularly on account of condition of roads.

MONTANA-BINGHAM (Bingham)—Ore running unusually high in copper was cut by lessees in north drift in Bingham Amalgamated ground.

MAXFIELD (Salt Lake)—Payment made on this Big Cottonwood property under bond and lease by F. H. Vahrenkamp. Electrically driven pumps being installed to unwater old workings. Car lead-silver ore shipped from above tunnel level.

Summit County

SNAKE CREEK TUNNEL (Park City)—Average monthly advance during 1914 was 341 ft. Face of tunnel now under backbone of ridge at depth of 2500 feet.

Tooele County

CLIFF (Ophir)—Zinc ore has been developed at this property and shipment will soon be started.

WASHINGTON

GOLDEN KING (Spokane)—Plans erection of new milling plant near Oroville, Wash.

IDAHO PLACER (Spokane)—Company owning about 1000 acres placer ground in Idaho and Washington reported, by Pohlman Investment Co., agents, ready to invest $18,000 for machinery and equipment.

WASHINGTON & NEVADA DEVELOPMENT (Bellingham)—Having plans prepared for number of improvements at its mining properties near Virginia City, Idaho. Property will be equipped with 50-ton concentrator, 10-stamp mill, cyanide tanks, etc.

CANADA

Ontario

REA (Porcupine)—Has stopped underground development and let contract for diamond drilling.

KRIST (Porcupine)—Will be developed this year by an English company. The property adjoins the Porcupine Crown.

LALLY (Porcupine)—Will carry on more extensive development work this season. Main vein on 100-ft. level shows 12 ft. of $5 ore.

NIPISSING (Cobalt)—Production cost per ounce for past year was 18c. which is about 6c. lower than for preceeding year. Earnings for year about $1,600,000.

TEMISKAMING (Cobalt)—Rich vein coming in from Beaver continues to show improvement. Opened up for 80 ft. on 400-ft. level and 125 ft. on 500-ft. level.

PETERSON LAKE (Cobalt)—Statement for quarter ended Jan. 31 shows surplus of $182,380 as compared with $208,471 for previous quarter. During period 20 sacks of ore were obtained.

CANADIAN COPPER (Copper Cliff)—Has authorized the expenditure of $500,000 to sink new shaft at Creighton Mine and to erect 85 workmen's houses and several new mine buildings.

HOLLINGER (Porcupine)—Regular 4-weekly statement for period ended Feb. 25, shows gross profits $154,714, from 22,438 tons of ore, average value $11.39 per ton, working costs $3.98 per ton milled. Mill ran 96.3% of time. Motor cars equipped with storage batteries have been installed in mine to convey ore from working shafts.

COBALT TOWNSITE (Cobalt)—Solid piece of high-grade silver ore about 4 ft. square and 10 in. thick weighing approximately 2600 lb. and assaying 4000 oz. per ton, found in doing surface work on vein located about a year ago. Was concealed by an overburden of 4 ft. of earth. Vein has been stripped for some distance.

MEXICO

Chihuahua

CIENEGA (Ocampo)—Second payment on this mine, made by Qualey Bros., of New York, purchasers; about 100,000 tons of $20 ore are blocked out above 500-ft. level. Are installing cyanide plant, 2000 tons, monthly capacity. Adit will be driven to explore mine at depth.

YOQUIVO IMPROVEMENT (Yoquivo)—Is operating its mines and 20-stamp mill at practically normal output. Company has hydro-electric power plant five miles from mine which supplies 175 hp., which is a little short of requirements; deficiency is supplied by 175-hp. Corliss engine. Wood is used for fuel.

CUSI MEXICANA (Cusihuiriachic)—Has its mill about ready to operate, and the Cusi Mining has started work on a 100-ton mill in which it is said flotation process will be used to treat large tonnage of lower grade ores that have accumulated during last six years; no ores carrying less than 60 oz. silver per ton having been shipped.

CORRIGAN & McKINNEY (Concheño)—This firm of Cleveland, Ohio, is doing great deal of development work on their mines in western Chihuahua. Tunnel several thousand feet in length being driven to develop orebody at depth of about 600 ft. below present workings. Mine equipped with large mill and cyanide plant has for years been steady producer of gold and silver. Reported to have recently purchased the Hidalgo mine 15 miles northeast of Concheño, from which place transmission line will be built to carry current from hydro-electric power plant of the Concheño mines.

Hidalgo

UNITED STATES S. R. & M. CO. (Pachuca)—Real del Monte and Pachuca properties handling 1400 tons per day, short while ago tonnage down to 400, normal mill capacity 2000 tons. Comparatively little hostility shown by insurrectionists at any time. No property damage.

CHILE

CHILE COPPER (Chuquicamata)—Cable from Pope Yeatman quoted announcing expected starting up of power plant middle of April. Plant will then be ready to supply current to mine and mill.

The Market Report

METAL MARKETS

NEW YORK—Mar. 31

Copper, tin, lead and zinc have all been higher, the strength of copper being especially noteworthy. The tin market is in a condition which causes it to experience erratic fluctuations.

At the annual election of the New York Metal Exchange, Mar. 29, the following officers were chosen: President, A. B. Hall; vice-president, Edwin Groves; treasurer, Chas. S. Trench. Members of the board of managers, H. W. Hendricks, Emil Baerwald, W. Parsons Todd, Erich Benjamin, L. Vogelstein, Julius Loeb, Edward W. Starke, Tobias Wolfson. Arbitration committee, Charles J. Marsh, J. H. Lang, R. F. Pearson, Edwin J. Keane, C. M. Loeb. Inspectors of election, C. H. Bolles, Jr., Fred Steiner, J. J. Archer; C. Mayer, secretary.

Copper, Tin, Lead and Zinc

Copper—The situation in this metal is just as we summarized it last week, viz., a strong statistical position and producers well sold ahead, wherefore the market exhibits a rising tendency upon a relatively small demand. Business during our last week of record was of only moderate volume and even so the sales of producers were largely in foreign markets. Yet there was a sharp advance in price. At the beginning of the week some round lots were sold to domestic consumers at 15⅜c., regular terms, corresponding to about 15.20c., cash, New York. By March 29, 15¾c. was realized on some small business, but there were free sellers at 15½@15⅝c., regular terms. Toward the end of March 30, sellers realized 15⅝c., regular terms, on some substantial sales, and on March 31, the market was about 15⅝@15¾c., regular terms. Higher prices have been realized on sales for delivery to certain non-competitive points and upon sales in London which at the moment is the best copper market. On March 30-31, copper was quoted in London at £76¼, and sales were effected there at £76, equivalent to about 16¼c. per lb. Such a price was realized, however, only on copper already over there or by shippers who could make quick delivery from here. However, shipments cannot be freely made on account of the scarcity of freight room, which, of course, is the reason why the London market is entirely out of joint with New York.

There were some peculiarities in the domestic market last week. Sellers who were able to make deliveries abroad or to non-competitive points in this country were indifferent with regard to the Eastern market, and asked prices considerably above the figures at which there were free sellers. Among the latter there was reported in some quarters an inability to sell at the prices that were reported realized in other quarters. It was rumored that some copper previously bought speculatively was being offered for resale by second-hands.

Exports of copper from the United States for the week ended Mar. 13 are reported by the Department of Commerce at 19,039,265 lb. The larger items were 9,222,174 lb. to Italy, 8,332,748 lb. to Great Britain and 1,121,155 lb. to France. Imports included 2,677,313 lb. metal and 5,017,044 lb. in ore and matte; 7,694,357 lb. in all. The greater part came from Chile.

Copper sheets were advanced ¼c. on Mar. 25 and again ¼c. on Mar. 27; the base price is now 20¾c. for hot rolled and 21¾c. for cold rolled. Usual extras charged and higher prices for small orders. Copper wire is quoted at 16½@16¾c. per lb. carload lots at mill.

Tin—This market has continued to be only a nominal affair, the price being swung cents per pound by selling offers or buying orders of only a few tons. At the beginning of March, the stock on hand was 2000 tons, and 2100 tons was imported during the month, making a total supply of 4100 tons. Atlantic Coast deliveries were 2300 tons and Pacific Coast deliveries, 900 tons, a total of 3200 tons, leaving a stock of 900 tons on hand at the end of March.

The British Government has prohibited the exportation of tin from the Straits to other than British ports. Efforts are being made to obtain special permits for shipments to consumers in the United States.

The British Board of Trade states that applications for licenses to export to the United States tin, chloride of tin, and tin ore (recently placed in the British embargo list) will in general only receive consideration when shipments are to be consigned to the British consul general at New York. Shipment of these products to the Netherlands will only be permitted when consignment is to the Netherlands Oversea Trust, and exportation is only allowed to such of the other neutral European countries as have placed an embargo on tin, chloride of tin, and tin ore.

Lead—Sales for export were again large, although the participation in this business was not so general is in previous weeks. The business was hampered by inability to obtain sufficient freight room. Buying for export in St. Louis has raised the price in that market almost to even terms with New York. There were some domestic inquiries for tonnages in the

DAILY PRICES OF METALS IN NEW YORK

Mar.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
25	4.7950	50½	15.20 @15.25	*46	4.15 @4.20	4.10 @4.20	*8.17½ @8.92½	*8.00 @8.75
26	4.8000	50½	15.25 @15.30	*47	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75
27	4.7988	49½	15.25 @15.35	*47	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75
29	4.7950	50⅛	15.35 @15.55	*53	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75
30	4.7988	50⅜	15.45 @15.55	*52	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75
31	4.7975	49⅞	15.50 @15.60	*52	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75

* Nominal.

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. or domestic business The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c: St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Mar.	Silver	Copper				Tin		Lead		Zinc	
		Spot									
		£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
25	23 11/16	68½	14.88	69½	....	162½	161½	23½	5.02	44½	9.67
26	23¾	68¾	14.94	69⅞	....	165¾	164	23½	5.02	44½	9.67
27	23⅞	.....	.....	.....	.....	.....	....	.....	.....	....	....
29	23⅞	68½	14.88	69½	....	170	166½	23½	5.02	44½	9.67
30	23¾	69	14.99	69⅝	....	172½	168¾	22½	4.89	44	9.56
31	23½	69¼	15.05	69⅞	....	171	168½	22½	4.89	44	9.56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £ 15 = 3.21c.; £20 = 4.28c.; £30 = 6.42c.; £40 = 8.55c.; £60 = 12.83c. Variations, £1 = 0.21⅜ c.

market but whether they reflected an ultimate use of the metal in this country, or not, is another matter. However, there were some moderate inquiries for municipal work, which is to be expected at this season of the year.

Spelter—Business amounting to some hundreds of tons of spelter for April-May delivery was done during the week, first at prices of 8@8¾c., according to delivery, then at 8¼@8¾, the range showing a tendency to contract. This market is not, however, upon a wholesale basis, producers being unable to dispose of round lots at the present level. Domestic consumers show no interest whatever in deliveries beyond May, and scarcely any interest in April and May. Nor does Europe exhibit any disposition to buy at present prices. The market holds up simply for the absence of any pressure to sell, producers waiting to see whether Europe is going to buy at the present level or not. During the last week some small sales were made to France. Some producers are entirely sold out for April, but others have considerable April spelter available. For May the position is undoubtedly easier. The test of this market will come when either sellers or buyers try to put it on a wholesale basis.

Zinc sheets are quoted today at $13.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The manufacturers are receiving a number of inquiries from abroad.

Other Metals

NEW YORK—Mar. 31

Aluminum is a little more active than it has been, but still rather quiet. Prices are unchanged, at 18¾@19c. per lb. for No. 1 ingots, New York—**Antimony** is scarcer and future supplies uncertain, owing to foreign embargoes and war demand. Ordinary brands bring 21½@23c. per lb., and an advance is expected. Cookson's is nominal and hard to get; 31@32c. per lb. has been paid—**Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** is still in rather short supply. For large lots in New York the price is nominally $67 per flask of 75 lb., with no sales reported. Small lots have sold at $75@80 per flask. San Francisco price is reported at $62.50@65 per flask for domestic orders; market quiet. London price is £12 10s. per flask, with £12 5s. named from second hands.

Gold, Silver and Platinum

Silver—The market has been more erratic the past week resulting in a decline. Reports from London, however, are to the effect that allowing for reactions the outlook for silver is considered rather favorable.

Platinum—The platinum market remains dull and quiet, with small business reported. Prices are unchanged at $38@40 per oz. for refined metal and $43@47 per oz. for hard metal, according to grade.

Our Russian correspondent writes that there is little change in the market. From Ekaterinburg it is reported that firm holders are gradually concentrating the offerings of platinum made by small producers and speculators. Prices quoted for crude metal, 83% platinum, are 8 rubles per zolotnik at Ekaterinburg, and 31,000 rubles per pood at Petrograd—equal to $30.08 and $30.38 per oz., respectively.

A general meeting of Russian gold and platinum producers is being held at Petrograd. A special report on the platinum industry and the effects of the war thereon is to be presented.

Zinc and Lead Ore Markets

JOPLIN, MO.—Mar. 27.

Blende, high price, $63; assay base, 60% zinc low in lead, $60@58; with increase of lead base declined to $48; metal base, $52@46; calamine base, 40% zinc, $35@30; average, all grades of zinc, $59.84. The apparently high average is caused by over half the shipment being purchased one week ahead of settlement. Lead, high price, $53; base, $50 per ton of 80% metal content; average, all grades of lead, $50.99 per ton.

The shipment is an increase of 900 tons blende and a decrease of 350 tons of calamine. Buying orders for blende were largely increased at the lower level of prices.

SHIPMENTS, WEEK ENDED MAR. 27

	Blende	Calamine	Lead	Values
Totals this week	10,583,140	494,370	1,313,060	$364,940
Totals this year	127,315,570	11,457,010	19,028,200	4,542,800

Blende value, the week, $323,050; 3 months, $3,883,410.

Calamine value, the week, $8410; 3 months, $208,650.

Lead value, the week, $33,480; 3 months, $450,710.

PLATTEVILLE, WIS.—Mar. 27

The base price paid this week for 60% zinc ore was $58@60 per ton. The base price paid for 80% lead ore was $51 per ton.

SHIPMENTS, WEEK ENDED MAR. 27

	Zinc Ore, lb.	Lead Ore, lb.	Sulphur Ore, lb.
Week	3,298,710	61,000	387,730
Year to date	47,572,970	679,390	4,359,330

Shipped during week to separating plants 3,072,030 lb. zinc ore.

Iron Trade Review

NEW YORK—Mar. 31

The iron and steel markets continue to show a cheerful tone. Domestic orders have been moderate only, but export business is heavy, and the mills are kept up to a good average.

The pig-iron market has been stirred up by large sales of foundry iron by the Buffalo group of furnaces. The iron was offered at a reduction, $12 per ton at furnace for No. 2X foundry, and found many buyers both in small and large lots. Sales were made covering second and third quarters.

There is some talk of speculative buying, especially of Southern iron, but nothing at all definite has been brought out.

Steel Rail Production in the United States in 1914, according to the preliminary statement of the American Iron & Steel Association, was 1,945,095 long tons. This compares with 3,502,082 tons in 1913, and with 3,977,887 tons in 1906, the year of greatest production.

PITTSBURGH—Mar. 30

Unofficial estimates are that the export bookings of the Steel Corporation since the first of the year have been running at close to a quarter million tons a month, and while such estimates may possibly be excessive the total bookings, including the unusually large proportion of export business now being taken by the independent steel interests, are in all probability more than double the rate at which export shipments were actually made during the first six months of the war.

In all branches of the finished steel trade bookings of domestic orders have lately been fully as great as at any time since the general improvement started four months ago and in the past two or three weeks the majority of mills have had better bookings than at any previous time in the movement. For two months those who at first doubted the genuineness of the steel movement have been looking for signs of a falling off in demand and have found none.

The steel mills are operating at between 65 and 70% of their ingot capacity, and in several branches of the finishing trade, such as wire, tinplate, steel pipe and merchant bars, operations are almost normal. The structural business has been extremely dull, but is looking up somewhat. Specifications are now beginning to come in at a fair rate against rail contracts placed some time ago.

IRON ORE

A few cargoes of Cuban and Swedish iron ore have arrived at Philadelphia and Baltimore, but imports so far this year have been light.

Nothing has been done yet as to Lake ore prices for the season. It is expected that the opening of the season on the Lakes will be late.

COKE

Coke production for the week in the Connellsville region is reported by the "Courier" at 279,442 short tons; shipments, 281,384 tons. Production in the Greensburg and upper Connellsville districts, 37,176 tons.

Chemicals

NEW YORK—Mar. 31

The general market shows rather more firmness, though business is rather irregular in most lines.

Arsenic—Demand is not large, but supplies are only moderate and rather uncertain, at least so far as importations are concerned. Quotations are about $4 per 100 lb., for both spot and futures.

Copper Sulphate—Business continues steady. Prices have been again advanced 25c. and are now $6 per 100 lb. for carload lots and $6.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business has been fair. Prices are rather firmer, and 2.30c. per lb. is quoted for all positions this year.

Pyrites—Imports at Baltimore during the past week included two cargoes, 8198 tons, of pyrites from Huelva, Spain.

PETROLEUM

Exports of mineral oils from the United States in February were 151,742,942 gal.; an increase of 1,199,509 gal. over February, 1913. For the two months ended Feb. 28 the total exports were 313,836,208 gal. in 1914, and 298,512,643 gal. in 1915; a decrease of 15,323,565 gal., or 4.9%, this year.

Assessments

Company	Delinqe	Sale	Amt.
Big Elk, Ida	Apr. 15	May 15	$0.001
Bobby Anderson, Ida	Apr. 12	May 3	0.0025
Caledonia, Nev	Mar. 8	Mar. 31	0.05
Challenge, Nev	Mar. 31	Apr. 21	0.05
Confidence, Nev	Mar. 11	Mar. 31	0.10
Copper King, Ida	Mar. 1	Apr. 1	0.005
East Hercules, Ida, (post.)		Apr. 7	0.001
Eastern Star, Ida	Mar. 25	Apr. 25	0.002
Emerald, Utah (three instal.)		June 9	0.01
Enterprise, Ida	Mar. 20	Apr. 20	0.002
Florence, Ida	Apr. 15	May 4	0.001
Galena King, Utah	Mar. 25	Apr. 25	0.0075
Gethin Le Roy, Utah	Apr. 21	May 6	0.01
Giant, Ida	Apr. 9	May 14	0.002
Great Falls, Utah	Mar. 18	Apr. 22	0.01
Idaho-Nevada, Ida	Mar. 10	Apr. 2	0.002
Indiana, Mich	Feb. 4		1.00
Ivanhoe, Ida	Apr. 10	May 10	0.002
Jack Waite, Ida	Mar. 1	Mar. 24	0.01
Kentuck, Nev	Mar. 18	Apr. 7	0.02
Keystone, Utah. (post)	Feb. 23	Mar. 23	0.02
Laclede, Ida	Mar. 20	Apr. 6	0.003
Lucky Boy, Nev	Apr. 9	Apr. 28	0.01
Majestic-Idol, Nev	Dec. 15	Jul. 20	0.005
Nabob, Ida	Mar. 18	Apr. 12	0.005
Neva, Utah	Mar. 18	Apr. 12	0.002
Nevada-Douglas, Nev	Apr. 24		0.10
Oreano, Ida	Mar. 25	Apr. 26	0.0015
Pandora, Ida	Apr. 15	May 7	0.003
Pioche Metals	Mar. 20	Apr. 20	0.0025
Rio Grande, Utah	Mar. 25	Apr. 17	0.003
Saltese, Ida	Mar. 1	Apr. 1	0.002
Samson, Ida	Apr. 3	May 3	0.002
Selma, Utah	Mar. 20	Apr. 6	0.0025
Silver Cliff, Ida	Apr. 3	Apr. 24	0.0025
Smuggler	Apr. 17	May 17	0.0025
Sonora, Ida	Mar. 15	Apr. 15	0.002
Sunset, M. & D., Nev	Mar. 27	May 3	0.015
Syndicate, Ida. (post.)		Jan. 28	0.001
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tonopah Midway, Nev	Mar. 12	Apr. 12	0.01
Utah, Nev	Mar. 25	Apr. 15	0.02
Wolf Mountain, Utah	Mar. 15	Apr. 14	0.0015

Stock Quotations

There was a slight reaction in stocks last week, followed by advances to new high levels. Bethlehem Steel was the market feature.

COLO. SPRINGS Mar. 30		SALT LAKE Mar. 30	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.03½	Beck Tunnel	.06
Banner	.01½	Black Jack	.11½
Crippie Cr'k Con	.008	Colorado Mining	.10
C. K. & N	.05	Crown Point	.01
Doctor Jack Pot	.08	Daly-Judge	5.00
Elkton Con	.45½	Gold Chain	.07
El Paso	1.35	Grand Central	.53
Findlay	.03½	Iron Blossom	1.02½
Gold Dollar	.02	Little Bell	.15½
Gold Sovereign	.05½	Lower Mammoth	.06
Isabella	.15	Mason Valley	1.10
Jack Pot	.06	May Day	.12
Jennie Sample	.02	Opohongo	.00½
Jerry Johnson	.03½	Prince Con	.38½
Levington	.005	Seven Troughs	.02½
Mary McKinney	.32	Silver King Coal'n	2.97½
Pharmacist	.01	Silver King Con	1.72½
Portland	1.17	Sioux Con	.03½
Raven B. H	.03½	Uncle Sam	.04
Vindicator	1.55	Yankee	.04

TORONTO Mar. 30			
Bailey	.02½	Dome Exten	.13
Coniagas	4.75	Foley O'Brien	.25
Peterson Lake	.20	Hollinger	24.00
Right of Way	.02	Imperial	.01½
Seneca Superior	1.25	Jupiter	.13
Silver Queen	.01½	McIntyre	.44
T. & Hudson Bay	20.00	Pearl Lake	.02½
Timiskaming	.33	Porcu. Gold	‡.25
Wettlaufer-Lor	.05	Preston E. D.	.02
Big Dome	13.00	Rea	.20

SAN FRANCISCO Mar. 30			
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.80	Belmont	4.60
Belcher	‡.30	Jim Butler	.84
Best & Belcher	.06	Lone Star	.06
Caledonia	.22	MacNamara	.03
Challenge Con	.06	Midway	.17
Confidence	.15	Mont.-Tonopah	.37
Con. Virginia	.06	North Star	.15
Crown Point (Nev.)	‡.32	Rescue Eula	.11
Gould & Curry	.04	West End Con	.61
Hale & Norcross	.04	Atlanta	.39
Julia	‡.01	Booth	.30
Mexican	.27	C.O.D. Con	.03
Occidental	.79	Comb. Frac	.08
Ophir	.05	Jumbo Extension	1.05
Overman	‡.10	Pitts.-Silver Peak	.12
Potosi	.01	Round Mountain	.36
Savage	.04	Sandstorm Kendall	.09
Sierra Nevada	.05	Silver Pick	.08
Union Con	.10	Central Eureka	‡.25
Yellow Jacket	‡.47	So. Eureka	‡2.25

N. Y. EXCH. Mar. 30	
Name of Comp.	Clg.
Amalgamated	62½
Am.Sm.&Ref.,com	68⅜
Am. Sm. & Ref., pf.	103½
Am. Sm. Sec., pf. B.	78
Anaconda	28⅜
Batopilas Min	.50
Bethlehem Steel	88½
Bethlehem Steel, pf.	104½
Chino	39½
Colo. Fuel & Iron	26½
Federal M. & S., pf.	28
Great Nor., ore., ctf.	35
Guggen. Exp	54
Homestake	114
Inspiration Con	24⅜
Mex. Petroleum	73
Miami Copper	24½
Nat'l Lead, com	63
National Lead, pf	107½
Nev. Consol	12½
Ontario Min	2
Phelps Dodge	‡175
Quicksilver, pf	.75
Ray Con	19½
Republic I&S, com	22½
Republic I&S, pf	78⅜
SlossSheffi'd, com	29
Tennessee Copper	29½
Utah Copper	56½
U. S. Steel, com	48⅜
U. S. Steel, pf	105½

N. Y. CURB Mar. 30	
Name of Comp.	Clg.
Beaver Con	.34
Big Four	.08
Blue Bell	.03½
Braden Copper	7½
Buffalo Mines	.50
Can. Cop. Corpn	‡1
Can. G. & S	.04
Caribou	‡.47
Cashboy	.08
Chambers Ferland	.19
Con. Ariz. Sm	11/16
Con. Coppermines	1 1/16
Davis-Daly	1
Diam'field-Daisy	.06½
Dia. Black B	.03
Florence	.56
Goldfield Con	1⅛
Goldfield Merger	.25½
Greene Cananea	30½
Kerr Lake	4 11/16
La Rose	11/16
McKinley-Dar-Sa	.41
Mines of Am	2½
Mutual Min., pf	‡2½
Nevada Hills	.23
New Utah Bingham	.62
Nipissing Mines	6⅜
Ohio Copper	.12
Oro	.12
Pacific Smelt	‡.09⅜
South Utah	.25
Stand'd Oil of N.J.	395
Standard S. L	1⅜
Stewart	2
Tonopah	7½
Tonopah Ex	2⅜
Tonopah Merger	.39
Tularosa	‡.12½
West End Ex	.07½
Yukon Gold	2⅜

LONDON Mar. 18			
Alaska Tre'dwell	£7	0s	7½
Camp Bird	0	6	3
El Oro	0	8	0
Esperanza	0	9	0
Mexico Mines	3	15	0
Oroville	0	11	9
Philippine Dr	1	0	0
Santa Gert'dis	0	8	0
Tomboy	1	3	6
Tough Oakes	0	14	3

BOSTON EXCH Mar. 30	
Name of Comp.	Clg.
Adventure	2⅜
Ahmeek	320
Alaska Gold M	34½
Algomah	2⅜
Allouez	45⅜
Am. Zinc	30
Ariz. Com., ctfs	4⅜
Bonanza	.35
Butte-Balaklava	2½
Butte & Superior	48½
Calumet & Ariz	60½
Calumet & Hecla	463
Centennial	19
Copper Range	45⅜
Daly West	2½
East Butte	10⅜
Franklin	7½
Granby	72⅜
Hancock	14
Hedley	26⅜
Helvetia	.75
Indiana	7½
Island Cr'k, com	43
Island Cr'k, pfd	86½
Isle Royale	23½
Keweenaw	2½
Lake	11⅜
La Salle	5⅜
Mass	8⅜
Mayflower	5⅜
Michigan	1½
Mohawk	62⅜
New Arcadian	6⅜
New Idria Quick	13½
North Butte	27½
North Lake	2⅜
Ojibway	1½
Old Colony	5⅜
Old Dominion	45½
Osceola	72
Quincy	67½
Santa Fe	1½
Shannon	6⅜
Shattuck-Ariz	26
Superior	32⅜
Superior & Bost	1⅜
Tamarack	37½
Trinity	4
Tuolumne	.27
U. S. Smelting	23⅜
U. S. Smelt'g, pf	42½
Utah Apex	3 1/16
Utah Con	11½
Victoria	2
Winona	3⅜
Wolverine	48½
Wyandot	.80

BOSTON CURB Mar. 30	
Name of Comp.	Bid.
Alvarado	.70
Bingham Mines	‡3
Boston Ely	.15
Butte & Lon'n Dev	.26
Calaveras	1⅜
Calumet-Corbin	.12
Chief Con	.99
Corbin	.40
Cortez	.15
Crown Reserve	.80
Eagle & Blue Bell	.91
First Nat. Cop	1½
Houghton Copper	2⅜
Iron Cap Cop., pf	3
Majestic	.15
Mexican Metals	.16
Nevada-Douglas	.36
New Baltic	2
Oneco	1 1/16
Raven Copper	‡.07
Smokey Dev	.19
So. Lake	6½
Tonopah Victor	‡.17
Trethewey	.12
United Verde Ext	3

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	.....	27.416	26.958	.....
May	60.361	58.175	.....	27.825	26.704	.....
June	58.990	56.471	.....	27.199	25.948	.....
July	58.721	54.678	.....	27.074	25.219	.....
August	59.293	54.344	.....	27.335	25.979	.....
September	60.640	53.290	.....	27.986	24.260	.....
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.485	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	.....	64.747	.....	69.313	.....
May	13.996	.....	63.182	.....	67.786	.....
June	13.603	.....	61.336	.....	66.274	.....
July	13.223	.....	60.540	.....	64.955	.....
August	*	.....	‡	.....	‡	.....
September	*	.....	‡	.....	‡	.....
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53.227	.....	*	.....
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	.....	163.963	.....
May	33.360	.....	150.702	.....
June	30.577	.....	138.321	.....
July	31.707	.....	142.517	.....
August	*	.....	‡	.....
September	32.675	.....	‡	.....
October	30.284	.....	‡	.....
November	33.304	.....	139.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	.....	3.688	.....	18.225	.....
May	3.900	.....	3.808	.....	18.503	.....
June	3.900	.....	3.810	.....	19.411	.....
July	3.891	.....	3.738	.....	19.051	.....
August	3.875	.....	3.715	.....	‡	.....
September	3.828	.....	3.658	.....	‡	.....
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	.....	4.963	.....	21.569	.....
May	5.074	.....	4.924	.....	21.393	.....
June	5.000	.....	4.850	.....	21.345	.....
July	4.920	.....	4.770	.....	21.568	.....
August	5.568	.....	5.418	.....	‡	.....
September	5.380	.....	5.230	.....	‡	.....
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	.....	13.90	.....	14.13	.....
May	14.90	.....	13.90	.....	14.27	.....
June	14.90	.....	13.90	.....	13.96	.....
July	14.90	.....	13.90	.....	13.90	.....
August	14.90	.....	13.90	.....	14.08	.....
September	14.90	.....	13.90	.....	14.03	.....
October	14.84	.....	13.75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....

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